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[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY, COLUMBUS, OHIO, Feb. 10, 1887.

To the Members of the Association:—The Third Annual Meeting of the Ohio Gas Light Association will be held in Dayton, Ohio, on the 16th and 17th of March, next.

As a stimulus to a good attendance, and to add interest to the meeting, as well as to obtain the best views of the gas men of the State upon a vexed subject, the President of the Association offers a reward of $25 for the best, and $10 for the next best paper upon the following subject—the only condition being that there shall be not less than three papers presented thereon—"How Shall We Get Rid of Naphthaline Crystals about the Works, and Still Maintain High Heats?"

Let every gas man in the State not only make his arrangements to attend our Dayton meeting, and also at least come prepared to participate in the discussion of the subjects named in circular list, published in the JOURNAL, issue of January 17th. IRVIN BUTTERWORTH, Secy.

VARYING PHASES OF THE LIGHTING QUESTION IN BROOKLYN, N. Y.

The city of Brooklyn, at least in the matter of those things which pertain to certain of her artificial light supply industries, has occupied a prominent place of late in the "eyes of the State," the visual organs this time being located at Albany, or the region which now holds possession of the Empire State's lawmakers. Not such a great while ago our item columns contained allusion to the profuse manner in which Brooklyn was being served with "half arcs" for public lighting; and in fact we do not think that a more extravagant supply of this particular sort of illumination (not even excepting Buffalo) was or ever will be witnessed in any city on the face of the globe. The quagmires of Gowanus, the purlieus of Red Hook Point, the bleak hills of the eastern slope—sometimes called "Crow Hill"—and the odoriferous region that approximates to the boundaries of Long Island City, all bask beneath the effulgence of the sparkle from betwixt the carbon points. Of course, the other sections of the City of Churches, or those wherein the business man displays his wares, or where the "upper circles" dwell within their ostentatious habitations, were not slighted in the generous allotment of the carbon points. No; on rich and poor alike the light of the arc descends! And that uninvidious action proves the democracy of those who furnish the current—and collect their pay therefor from the common treasury. Indeed, in our former reference to this peculiarity in the Brooklyn situation, we ventured the prediction that the law might some day or another cause trouble to the controllers and abetters of our sister city's electric lighting, and that interference came sooner than we thought. The January Grand Jury attempted to probe the matter, and while they did not present a formal indictment against any of the individuals who comprise the electrical coterie, they did in general terms arraign those worthies severely, the arraignment taking the form of an open letter, so to speak. Perhaps a set presentment would have been effected were it not for the "legal advice" given by the present District Attorney, who, it may be explained, is in thorough accord with the political party now in power; and it may be further said that some of the leaders of that political party are owners of the electric lighting com-

panies. At any rate, the Grand Jury's arraignment appears to have had weight enough with the Albany Solons to cause the latter to appoint a select committee, with power to send for persons, papers, etc., that has been instructed to investigate about every municipal department in the City of Churches. Of course, we are not blind to the fact that political partisanship is at the bottom of the Albany action; for one set of politicians who are "in" at Albany, but who are "out" at Brooklyn, seek to add the latter city to their list of possessions. Speaking frankly, we do not think the "investigators" will find that much corruption exists in the present management of Brooklyn's civic affairs, save in the single instance of the doings of those in charge of the public lighting. In any event, admitting that every arc light now in action was honestly contracted for, if corruption or collusion is not shown to exist or to have existed in the public lighting department, it is notoriously patent that extravagance and prodigality, of the most extensive nature, have ruled in connection with the electric lighting contracts. Lavishness may not be held to be criminal; but those officials who are prodigal in their disposal of the taxpayers' contributions ought to receive a stern reminder that incompetence can dissipate the funds about as thoroughly as the act of a peculator or defaulter.

Brooklyn's gas companies are also in a state of mind over what the future has in store for them. We would like to be able to say a good word for them; but the best that might be urged in their favor would at least constitute a lame defence. The greed of the past, added to the inanity of their course in regard to the early efforts of the Standard Oil Company's gas ring, now comes home with double force. Indeed, when an able man like ex-Senator E. B. Thomas, is obliged to resort to the specious style of argument employed by him, on the occasion of an appeal before the Committee of the Senate—Mr. Thomas represented the case of the Brooklyn gas companies—who were considering the Griswold bill to lower the Brooklyn gas rate to $1.50 per thousand cubic feet, we must condole with his employers. However, the Senate seems disposed to deal with the Brooklyn gas suppliers in a gentle mood, for the Committee have reported favorably a measure which, if finally passed, will place the rate for gas in Brooklyn at $1.60 per thousand, and every gas maker in the country will concede that figure ought to be satisfactory. Of course, we do not concede the right of the Legislature to interfere in the matter at all. We have all along contended that the courts would upset such interference, and we hold to that view now. Nevertheless, the Legislature has interfered, and so the Brooklyn companies must bow to that which is, and be satisfied with a slice when they cannot hope for the loaf. If common sense had guided them in the past the loaf would still be theirs.

WILL NEW YORK HAVE A GAS COMMISSION?

During the discussion that followed the presentation of Mr. Ramsdell's paper on "Gas Commissions," read at the Philadelphia meeting last fall, Messrs. McDougall, of Hornellsville, and McDonald, of Albany, predicted that legislation to provide for the establishment of a gas commission in the State of New York would undoubtedly take place next winter. "Next winter" having in the natural order of things become "this winter," we also note that the predictions made in Philadelphia are now verified. Elsewhere in our columns will be found the text of the Worth commission bill, which strikes us as being decidedly loose in its provisions, although, in the main, it may prove acceptable to the gas men of the State. But Senator Worth is not alone in the field, since one or two other Solons have presented similar bills. Perhaps the most important of these latter is the measure proposed in the Assembly by Mr. Erwin. The Erwin bill places the commissioners' compensation at $4,000 each per annum; provides for three commissioners; places their term of office at four years; and restricts the maximum annual total expense to $50,000. The Erwin proposal, it is said, meets with the approval of Governor Hill. However, all these propositions are inchoate; and, no doubt, many changes will be made in them ere their fate is finally determined.

THE ANNUAL REPORT OF THE MASSACHUSETTS COMMISSIONERS.

The Second Annual Report of of the Massachusetts Gas Commissioners has been printed, and it may be said to form a complete compendium of the gas business of that State. He who, having studied its pages, cannot obtain therefrom a thorough knowledge of the gas business of the Bay State, must be dull indeed.

Some time ago we believe it was said the principal trouble connected with the official duties of the commissioners was that these gentlemen had really so little to do; but we opine that the clerk to the Board, Mr. Walter S. Allen, does not share in such belief. The gas companies may also be placed in line with Clerk Allen's opinions in regard to the item of labor, for the queries which had to be answered were numerous and perplexing. We expect, from time to time, to furnish our readers with copious extracts from the report. Many surprising, instructive and entertaining matters are outlined on its pages.

[An address made to the Society of Gas Lighting (at a session held in the Stevens Institute of Technology, Hoboken, N. J. Thursday evening, Feb. 3d) by the President of the Institute. Especially reported for the JOURNAL, and revised for publication by the author.]

The Storage Battery.

By PRESIDENT HENRY MORTON.

I think some of the members of this Society may remember that about nine years ago I had the pleasure of addressing them, in connection with others, on the subject of electric lighting,* then beginning a somewhat sprightly infancy. The developments made by Mr. Edison were exciting attention, and he had been promising many remarkable things. At that time, among the points made, as illustrating that the progress in electric lighting would not be so extremely rapid as Mr. Edison or his friends indicated when they proposed to light New York within six weeks, I stated that what would probably restrain this very rapid progress was that in electricity there was then known no method of storage, by reason of which work could be done in preparing the electric energy at one time, and the prepared electricity be used at a subsequent period.

Now, this evening, I propose chiefly to draw your attention to what has been done in that particular direction since then, and will begin by alluding, in a few words, to something that was done at an earlier time. In the first place, it is manifest that some sort of storage of electricity is of very great importance. You all know how inconvenient it would be if a gas works had to be run, in which you made the gas hour by hour as it was required; how necessary it would be to have an extremely large plant, and to have its workings unusually precise and certain; in fact, it would be almost beyond possibility to make the output at specific times, and yet comply with more or less irregular demands. The same thing, of course, holds true with electricity; and one of the drawbacks and causes of increased expense in running electric apparatus has come, and will come for a long time yet, from the impossibility of storing satisfactorily this energy. As the result of this a plant has to be put up which will be able at one time to supply the maximum number of burners, and such a plant will, as things generally run, be used to its maximum capacity only for a very few hours out of the twenty-four. I think that statistics showed a year or two ago that the Edison plant was used to its full capacity on an average only about four hours out of the twenty-four, and therefore it was wasting itself, as it were, by not being used during the very much greater part of the time.

Another reason why a storage is desirable is the difficulty that exists, more or less, in keeping a perfectly regular supply of electricity—that is, that there should be no fluctuations. Great improvements have been made in machinery for that purpose, and great perfection has been already attained; but still this great precision is only attainable by extreme care and accuracy in the machinery and the running of it, all of which, of course, is a source of expense.

Now, in the case of electricity, up to the present time no *direct* method of storage can be suggested or has been approached. Of course, as you all know, electricity can be, to a certain degree, stored in a Leyden jar, and we can put a little bit into a condenser; but when we compare the quantities that can be so stored with the quantity used in an electric light we see how inadequate they are. If we had Leyden jars sufficient to fill this entire room they would not hold electricity enough to run one of these lamps for five minutes, and the cost of a condenser which would be capable of generating sufficient electricity to run one of these lights for an evening would be perhaps half a million of dollars. Therefore any such thing is out of the question.

So we are left to the method of storage of an indirect kind—that is, a storage of electricity by a transformation or conversion of energy. In that regard the storage of electricity which has been so far secured is precisely parallel with the storage of sunlight which nature has provided in the development of vegetable life. For example, the sun's rays fall upon a tree; the tree grows; wood substance is developed, and that wood afterward can be burned, and we can get from it energy in the form of light and heat, which is equivalent to and is in a sense the very same energy which fell upon it as sunlight. It has not been sunlight and sunheat during the intermediate time. It is turned from solar or light energy into chemical or potential energy in the plant, and then back again. The same thing is true of the energy by which we live and move—namely, the energy derived from our food. The energy that has come from the sun and has gone into the growing plant which the animal feeds upon has become chemical energy. If a plant is eaten by an animal this energy suffers another chemical change, but the carbon, hydrogen, etc., in the plant is that portion of the animal's food which maintains a warm temperature in its body and enables the animal to move and perform work requiring the expenditure of energy.

Now, in all these cases the chemical action, roughly described, is of this

* A Lecture delivered by President Henry Morton, before the American Gas Light Association, at the Stevens Institute, Hoboken, N. J., on Oct., 17, 1878. For report of same see JOURNAL, Vol. XXX., issue of Jan 2-16, and Feb. 2-16, 1878.

nature. There exists in the air a great quantity of carbonic acid, consisting of atoms of carbon and oxygen which are close together. The particles are as near to each other as they can get, and therefore they have lost all power of developing energy or doing work. As the sunlight falls upon the plant and makes it grow, that growth consists chiefly in a separation of the carbon and oxygen constituting the carbonic acid of the air. Of course there is a separation of the elements of water; but I may leave that out for the present for simplicity of expression. The carbon and oxygen are separated. The carbon is packed away in wood tissue, and the oxygen is preserved in the atmosphere. The supply of oxygen in the atmosphere is kept up, to a certain extent, by the growth of the plants.

The growing plant, then, gets from the sun the power of decomposing carbonic acid and pulling apart these two things—carbon and oxygen—which existed in it. Then those two things, when they come together again in the burning of the log, develop vibration of light and heat, and we get energy again, which may be used to run a steam engine or to give us light and heat. Also, when the carbon and its compounds are introduced into the system by digestion, and come to exist in the blood, they unite with the oxygen inhaled through the lungs; and again under these circumstances we get energy from this union of these elements, and we are kept warm and given the power of exerting our muscles and our brains.

Thus you see what sort of an action takes place when the sunlight, acting upon the growing plant, decomposes carbonic acid, and so stores up energy by separating things which were before combined, and which, when they reunite, will develop any form of energy that may be required, according to the conditions under which the reunion takes place. This is the general doctrine and theory of energy now universally accepted in relation to these things.

Now, the method which exists in what we call the storage battery for the preservation of electrical energy is of a precisely parallel character. (At this point Prest. Morton exhibited a small battery.) In this battery, whose structure I will describe more fully by and by, we have, to begin with, plates of lead with an acid solution between them. We pass an electric current through this (indicating), and the acid solution is decomposed. Taking the principal and neglecting the less important parts of the action, so as not to complicate the statement, we have a separation of oxygen from hydrogen, which exist combined together in the solution. The electric current in the battery, like the sunlight on the tree, causes the plates of the battery to separate these two elements. The oxygen draws to and combines with one plate; the hydrogen goes to the other plate and either remains there as such, absorbed in the plate, or remains there in effect by securing a decomposition of an oxide previously existing in the plate, and depositing the metal, lead, as a representative of what we may call the metal, hydrogen.

Here, again, we have a dead compound—the acid solution—whose particles are all so close together that they cannot move toward each other and obey the chemical attraction which draws them toward each other, and are therefore, without any power or energy. But when now, the electric current passing through the apparatus, it separates this compound and puts the oxygen on one side and the hydrogen, in effect, on the other. That having been done, we can at any future time take that arrangement of plates with the oxygen on one side and the hydrogen on the other, and, by making a metallic connection between the ends, cause the oxygen and hydrogen to reunite under conditions favorable for developing electric energy. When substances unite chemically they may develop any kind of energy according to the structure in which their reunion takes place. A chemical reunion in the body of a man will develop muscular energy causing motion, and heat energy, and brain energy. That same combination, taking place in a furnace, will develop heat energy and light energy. That same combination being, in fact, a union of the same substances, taking place in the arrangement which we call a galvanic battery will develop electric energy. Chemical combination, in other words, is capable of developing any sort of energy, the kind depending upon the mechanism in which the reunion takes place.

Here, then, is the principle involved in the storage of electricity. The term in one sense, of course, is a very inappropriate one. If it leads us to think that electricity, as such, is packed away like hay in a bale, it would be entirely misleading; but not so if we look upon it as the preservation of energy in the broader sense, which is now the accepted one all over the world—viz., that energy is one thing, though it may exist in a vast variety of forms, and that we preserve it, or we store it up, as long as we keep it in any form, provided it is so kept that we can ourselves use it afterwards.

Energy, though not stored, is not lost when it escapes us. It will continue to exist somewhere in the universe; but of course we do not consider it stored when it is not under our control, any more than we would consider grain stored if it were scattered on the river, although the grain might still be preserved somewhere.

The history of this invention of the storage battery is worthy of a few words, because it shows us how true all the way through is that remark made by Franklin, with which you are, of course, familiar, as illustrating the utility of scientific things, even though they at first promise little. Franklin, as you know, was one of the earliest discoverers of electric phenomena, and someone noticing his experiments (all of which were of an apparently useless character excepting that relating to the lightning rod), said to him, "What is the use of it?" And Franklin's reply was, as you remember, "What is the use of a baby?" In other words, the baby was of no use until it grew; but when it did grow it was time to look for usefulness.

It is a little interesting to see how eminently the science of electricity—in its inception a mere matter of amusement, a toy—has realized this idea. How wonderfully it has developed since it began to grow! When it was almost a baby—and most of us can remember that time, for the telegraph is perhaps hardly beyond the early recollection of most of us—it was only amusing and useless; but within the last few years it has developed marvelously, and now we have the telephone, electric lights, electric motors, and all sorts of things of the kind.

The subject of storing electricity began to be developed very far back, or in the first year of this century. In the year 1801 a French investigator, M. Gautherot, noticed that if terminals or electrodes of a galvanic battery were immersed in water, and were of platinum or silver, after the battery had been removed these terminals possessed the property of giving off from themselves a feeble current of short duration—if connection was made to an appropriate instrument for indicating feeble currents. (The lecturer here exhibited an apparatus for the decomposition of water, and illustrated Gautherot's discovery.)

This observation was repeated by Ritter, of Jena, in 1803; but he carried it a little further. He found that by piling a series of coins one on another, separated by bits of paper wetted with salt water, and connecting them with the poles of a battery, he could pass a current through the pile of coins; then on disconnecting the battery, and connecting the ends of the pile of coins with an instrument that would show an electric current (the instrument used in that case being the hind legs of a frog), there would ensue a convulsive movement of the frog's legs, which showed the existence of an electric current whose direction proved to be opposite to that of the charging battery. He then noticed that a guinea, which was a gold coin not chemically acted upon, could be charged so that—having taken a guinea piece and placed a piece of wet paper on each side of it, and passed a current through it, and then removed it from the battery—he could get an excitement of the frog's legs by connecting them with the two surfaces of the coin. It was, as compared with all the usual electrical experiments, a very surprising one at that time. Here was the beginning of the principle of the storage battery.

This same experiment was followed by others. Sir Humphrey Davy, De la Rive, and Faraday at last got hold of the true theory of this action, although they did not make any application in the direction of a battery. Finally, Grove, who distinguished himself both as a lawyer and as a physicist, in 1839 developed what is known as a gas battery, which is unquestionably the founder of the distinguished family of the storage battery. The gas battery of Grove can be exactly illustrated by this little apparatus which I have here (illustrating). He made something substantially like this, with mere trifling mechanical differences. There were two glass tubes properly supported in a vessel of acidulated water, and inside each of them rested a wire or a strip of the metal, platinum. He passed a current of electricity through these (indicating). Entering one tube, it passed down through the water and through and out by the wire in the other tube. As I have said, oxygen gas collected in one tube and hydrogen in the other. He allowed the current to pass through until both the tubes were nearly filled with the gas. He then stopped, and connected these two wires with a galvanometer, when he not only found that he had obtained a temporary electrical disturbance, but had secured a continuous one; that it went on day after day. However, as the electric current went on flowing he noticed that the oxygen disappeared from one tube and the hydrogen from the other—in other words, that the oxygen and hydrogen were combining, and producing an electric current (when they were left to do that), having previously been torn asunder by the forcible passage of an electric current in an opposite direction through the apparatus. Here was realized the fundamental idea of the storage battery. There was a way of storing electricity, in the sense of converting it into a chemical change; or, in other words, developing potential chemical energy in the apparatus, so that electric energy could be reproduced in the same apparatus.

Things rested here for a good while (indeed until about 1855) when a distinguished Frenchman, M. Gaston Planté, made another great step in advance. He recognized the fact that peroxide of lead was a peculiarly fit substance for use as one of the plates in an electric battery; that if he used this peroxide of lead as one plate he got fully two units of electromotive force, as we call it, whereas, with most other materials, the maximum effect that could be obtained was either one, or somewhat in excess of one. He, therefore, made a battery, using lead as the base, and discovered another thing. He found if a galvanic current were passed between two plates of lead im-

mersed in sulphuric acid solution, that one plate, after a time and after reversing the action several times, came to be covered with peroxide of lead, more or less thickly, on the surface, while the other plate came to be covered with a spongy layer of metallic lead. In other words, lead accumulated in a spongy, porous state on the surface of one plate, and the peroxide of lead accumulated thickly on the surface of the other plate. Now, on stopping the galvanic or charging current—in other words, the current that was producing this change—and allowing the plates to act as an ordinary battery to produce an electric current, he found that the peroxide of lead was reduced to a lower oxide—that is, it had parted with some of its oxygen—and that the metallic lead acquired some oxygen, taking it from the water in its neighborhood, and therefore giving off hydrogen, and that the hydrogen given up from one side, and the oxygen given up by the other side, combined to form water again. This action of combination was a source of energy which was developed as galvanic energy; in other words, produced an electric or galvanic current.

He also observed that the materials of this battery did not travel about; that the peroxide of lead became reduced to something of the nature of protoxide, and that the metallic lead became a protoxide, but yet both stayed just where they were at the start. This was another advantage in constructing an apparatus for the storage of electricity. If during the operation of the system the peroxide of lead had traveled about, and thus visited some other part of the battery, you can easily see that the apparatus, as a whole, would have gone to pieces; but staying as it did where you originally put it, it was manifest that you could again pass a current through it, peroxidizing the plate on one side, and reducing the plate on the other. That then you could use the effect thus developed, the chemical energy thus rendered available once more, the peroxide being again reduced to protoxide, and the lead being oxidized to protoxide. And by passing a current through once more you would again peroxidize one side and reduce the other, and be just where you were before, ready to start a fresh current.

Now, assuming those things just as I have described them, this seems to be the perfection of a battery for the storage of electricity—something which had a great power for a given amount of material, and everything remaining just where it was. But in reference to Planté's form of a battery, these statements needed to be qualified. In other words it was found that the oxides, etc., would not remain absolutely unmoved, that the peroxide would scale off—flakes of it would fall; also that the action, which was intentionally stimulated at first, of oxidizing the one lead plate and reducing the other to a spongy state—that this action, which was very desirable until you got the battery made, was undesirable afterwards, but nevertheless would continue to go on, or until the plate, which was intended to be a lead plate with a surface of protoxide, by-and-by got to be protoxide all the way through and fell to pieces. There were various little side actions, which I will not weary you by attempting to describe, and which are merely technical matters, that interfered very seriously. In short, then, though it took a long time to get the battery into good working shape, it was no sooner in first rate condition than it began to deteriorate.

This battery, in that shape, however, was known for a great many years. I remember when it was first talked about and experiments were made with it. One gentleman whom I knew quite well, Dr. Percival, of Philadelphia, worked at it a good deal. Years and years ago he took out several patents in relation to the matter. It was, however, about the year 1880 that the first radical step in advance of Plantè was made by M. Faure, a French inventor, who suggested that, instead of the long and tedious process which had been gone through with by Planté, to prepare his lead plates. They should be painted with a paste made of red oxide of lead, covering them with felt to keep the paste in place, and then in that condition should be put in the acidulated water, just as Planté did. Then a current being passed through the oxide (which was a powder) would be reduced to metallic lead on one plate, and oxidized to protoxide on the other. He found that that proceeding gave metallic surfaces covered with thick layers of metallic lead, or peroxide, as desired, and thus the storage capacity of the battery—or in other words, the amount of work which could be done by the current stored in it—was greatly increased. You can, of course, see that the more of these substances you have to react the more action you can get out of the battery, and the more current you can pass through in charging it. This made a marked improvement, and at first was hailed all over the world as a prodigious thing; but investigation and experiment proved there was still a very great lack in this apparatus. The trouble was that the oxide of lead, in this case also, after a certain amount of use, scaled off from the metallic plate behind, and so the battery became practically useless. As soon as this was noticed various inventors went to work, and probably the most successful of these in his solution of the difficulty was Swan, of England, who suggested the idea of taking a metal plate, punching it full of holes, causing or making the holes to flange outwards on both sides like the apertures for double dovetails, and then filling the holes with the oxides that were to be used. By this means he obtained something in which each little particle of the active agent, the oxide powder or base that was put in, was held in the framing of the plate, being in effect riveted on both sides.

(At this point the lecturer illustrated with a model.) You see that each piece of material, being pressed in, had a head on each side so that it was not liable to drop out. In the second place, you had the metallic connections running around all through this active substance, and you had a great deal of porous active substance. Here, for instance, is one of the plates that have been used (illustrating). When this gets plastered full of the oxide of lead the oxide so gotten into it will hold well; and besides, there seems to be, from the relative positions of the bars in the plates which are opposite each other, much less tendency for the formation of sulphate of lead between the active surfaces and the metallic frame or plate than there was in the flat plates of Faure.

This was a very great step in advance. It still left, however, the difficulty that the lead grating was a little acted upon, so that after considerable use a tendency to break up or disintegrate was apparent. These filled-in plates with the battery charged would last for a year or more, but after that time there was a tendency to break away. Now, quite recently it would appear that improvements had been made, and though I cannot say, from my own personal knowledge, yet it seems on pretty good authority that by alloying certain other metals, such as antimony and mercury, with the lead, a material can be made which is relatively unattackable, so that the acid does not have any effect whatever upon the plate or grating, and thus we may secure a very long life for these plates The plates, when prepared, are very different from each other; that is to say, the plate which is reduced to a spongy metallic lead has a light grey color. The outside one here is of that nature (indicating). Between those there is another set of plates, and the latter when looked at are of a dark slate color. These are the ones charged with protoxide (indicating), and are now manufactured at Newark, N. J., by the "Electrical Accumulator Company," who represent in this country a similar concern in England, the only difference being that the one in England is known as the "Electric Power Storage Company." They are manufacturing these now in great quantities, and they have already been put in use in a few places. Such a size as the one I have here has a capacity of 300 ampère hours—that is to say, it will give a current of one ampère, one unit, for 300 hours. In other words, it would transmit the current required by one incandescent lamp for 300 hours. It is also called a horse-power cell, meaning that the amount of energy contained by it is equal to one horse power for an hour. If there was any way of taking this charge out and converting it all into power it would be equivalent to a horse power for an hour; not that even theoretically it could do the work of a horse, because a horse in his ordinary day's work frequently works at a rate of much more than a horse power. A "horse's power," so called, is really the average work of a horse working steadily for ten hours a day without any special exertion.

[At this point a digression in the shape of a dialogue-discussion ensued.]

Mr. Vanderpool—What is the weight of that cell?

Prest. Morton—I think the weight of this is about 80 pounds. This particular cell is a new manufacture, and has only very recently come here.

Mr. Vanderpool—How many of those would be required in order to light your house?

Prest. Morton—That would depend upon the number of lights. If I wanted to run about 30 lamps, each of 16-candle power, I should require 20, or perhaps 25 of these; and they should be charged every day.

Mr. Greenough—Then it would take about a ton weight of those cells?

Prest. Morton—Yes; a little over a ton. I can tell you a little about that—that is, about the use which has so far been made of these things—giving you, so far as I can, what I know myself personally. Of course, there is much said about such things that is not very reliable. Now, in regard to my personal knowledge in this connection: On January 26, 1883, I used for the first time an installation of 25 batteries, substantially identical with this one, in my house. I had 25 of them put in, and connected with a dozen burners, which I hope to show you later on this evening. Those are used in this way: I had the battery charged, on the average, once every two weeks, and then it gave all the light I needed in two rooms (dining room and parlor) for two weeks, burning 12 lights. This would mean that occasionally all the lamps would be burning for the entire evening, when I had a dinner party, or something of that kind; but at other times I would only have one or two lights burning—just as we used gas. Of course, using only 12 lights with a battery of that size, I could use them for a long time without recharging; from one charge of the battery I could, in fact, run 10 lamps for 30 hours, or 30 lamps for 10 hours, or one lamp for 300 hours. These batteries ran very nicely for about six months, at the end of which time we began to have trouble, which trouble we did not understand at first, but found the cause of afterward. When these batteries were first sent out it was the opinion of everybody that for their proper management one must be very careful not to overcharge them; to stop the current the moment the lead was fully reduced on one side and fully oxidized on the other. At the end of about six months

we began to have trouble from some of the plates getting bent around so that they would completely mash out the thick bands of india rubber (placed between) and come in contact. Quite a number of them had to be taken out and replaced on this account. After a time, however, it was discovered that the method we had followed was all a mistake; that we must do just the other thing. We might overcharge the batteries as much as we pleased without ill effect; but we must not let them run down, for that formed a coating of sulphate of lead, and thereby created a tendency to bend and break up. By the time this was found out we had injured the battery to some extent, but we replaced a number of the plates, and then it ran with entire satisfaction for two years more, or until last summer, at which time I wanted it for use here in the Institnte and moved it over from my house. When the battery was moved we wanted to arrange the cells in a different way, and that led to the taking out of the plates. I found that a good many of them seemed to be as good as when they were put in. My impression from this experience is that these plates, as they were then made, are perfectly safe for two years. With proper care in running, and being careful to always charge them fully and to never let them run down too low, I believe they are perfectly safe for that length of time. That is the history of one installation. About six months or so after those were put in my house another set was put in a building at No. 80 Broadway, New York city, where they had a dynamo machine and also a battery. The dynamo ran during business hours; but at 6 o'clock, when the engineer and the fireman went away, the dynamo was stopped and the battery ran the lights all night—many lights from 6 to 9 P.M., and a few lights during the night—until the next morning when the dynamo was started again. The result has been very satisfactory. The owners of the building told me that they were satisfied with the running of the apparatus. The battery was, however, placed in a bad position. It was down quite near the engine and boilers, and the cells were liable to get very hot, and that made a little irregularity; but a few months ago they were replaced by new batteries made in this country—those that were used at first were imported from England—and since then the batteries have been running with entire success.

There is also an outfit which has lately been placed in the building No. 44 Broadway, New York, where the company that manufactures this battery has its office. They are just beginning to run them there, and I would advise any of you to step in and see them, either there or at No. 80 Broadway, if you are in that vicinity. Those are the only plants running in this vicinity that I know of at the present time. The reason they have not started more is that, though the company came to this country in 1883, there have been all sorts of legal complications affecting the ownership of the Faure, Swan, and other patents under which they operate. It has taken about three years for the company to straighten out matters by a series of civil suits, so that they might know whether they or somebody else owned the patents on which they proposed to work.

I have made no mention so far, in speaking about the history of the battery, of Mr. Brush's developments in that connection; but I do not know whether they particularly interest us now, because it is a mere question of patents. The form of battery made by Mr. Brush has not been a success. He put in several plants in New York in 1883. They were kept up for a few months, when they broke down entirely and had to be taken out. At Cheyenne, Wyoming Ter., they have, by force of persistent efforts, kept a plant going under the charge of one of our graduates; but the prospect even there is not encouraging. The only approach to success is on the Pennsylvania Railroad, where they have for a little over a year been lighting a number of cars which are run between New York and Philadelphia; and there it has been very expensive in the way of replacement of plates. Dr. Dudley, who has charge of affairs of that sort for the Pennsylvania Railroad, told me they were satisfied to continue their use because it was a nice thing to have in the cars, and they proposed to keep it up. They are trying to improve and cheapen this form of battery, and I imagine their efforts will meet with greater or less success in the near future. In 1884, I met Mr. Preece, the Superintendent of English Telegraphs, who told me he had for eighteen months been using in his house a set of cells of this general character with great satisfaction. He ran it in this wise: His gardener every day attended to starting up the engine—I believe it was a gas engine—which ran a small dynamo that charged the battery. When he had run it for so many hours he turned it out, and the rest of the apparatus took care of itself automatically. That is to say, when he shut off the engine the dynamo was cut off by an automatic switch from the battery. I have noticed in English electrical publications some letters showing that several private houses in England are lighted in that same way; and I have also seen a good many certificates, published by this English company, showing that Mr. So-and-so put in a battery in 1883, and says that it is still working successfully, and he is much pleased with it.

So, then, apparently something is being done. Dr. Dudley, who has just returned from a long tour in Europe, tells me that he saw a number of plants in England of that nature. It has worked better on a small scale where it did not come in competition with general electrical lighting or with gas lighting. Naturally, a new thing of this sort is expensive. It is not cheap by any means, nor do I anticipate that it is likely to become so; but in the way of luxury it is a nice thing. Of course, the absolute steadiness of the light, and its freedom from heat and from any vitiating effect upon the air, commend it to those who want the nicest and prettiest light that can be got regardless of expense.

Mr. Greenough—What proportion of electrical energy can you get out of that battery?

President Morton—I made a number of experiments in 1883, and found that we got out about 82 per cent. of the electrical energy put in—that is, measuring the quantity of current and the electromotive force in charging, and then taking the quantity and the electromotive force it had when it came out, I found that the latter was about 82 per cent. of the former. If it stood for about 16 days it lost about 7 per cent. more.

Mr. Greenough—How would it be after you ran it for a year or so?

President Morton—I was not able to make a test of that nature which I could regard as satisfactory and fair. I did make a test after the battery had run about a year; but the battery had then been somewhat maltreated, as I have before described, and, therefore, I do not think the test was fair to the battery. We found that the efficiency was then not much more than 50 per cent.—that is, we got out only 50 per cent. of what we put in.

Mr. Greenough—Can the lamps be connected with the battery and dynamo at the same time; or can you charge the battery and run the lamps both together?

President Morton—Certainly; and with the best effect. By such an arrangement the battery becomes a perfect regulator of the current for the lamps. This I once showed here in a striking manner as follows: Sometime in 1883 the Electrical Society of New York asked me if I would lecture to them upon something. Agreeing to the invitation I addressed them on the subject of the storage battery, and on that occasion I illustrated this point, here, in this wise: I had a number of electric lights, and I had a switch so arranged in connection with the dynamo machine that I could fluctuate the current that was developed by the dynamo in an extreme degree—bring it up to full brightness, and then reduce it to comparative darkness, by moving the switch backwards and forwards. I then connected the storage battery as a shunt, so that the current from the dynamo flowed into the storage battery and to the lamp by two parallel paths, and then back again into the machine from the other pole of the battery and from the lamps, so that if the current from the machine was cut down then the battery would take care of the lamp; or if the machine was giving current in excess it would overflow into the battery. Now, the moment the battery was thrown in as a shunt in that way you could not tell when the switch, which had before produced the violent fluctuations, was turned one way or the other, the lamps being absolutely steady. Of course, that depends upon proper arrangement. I cannot do that now with the battery here and the lights over at my house, the connection being only an ordinary telegraph wire.

Mr. Vanderpool—Do the lights keep up the same intensity after running awhile?

Prest. Morton—They do in a remarkable manner; until you get to a certain point, when the battery is nearly exhausted, there is substantially no change in the current. You start the current on from the battery, and from the first instant, if the battery has just been charged, for a minute or so it will drop off a little. After that the current would be represented by almost a perfectly level line for a great number of hours. For instance, if it would run for thirty hours, for the first fifteen minutes there would be a little drop. After that it would be sensibly steady, the drop not being more than one or two per cent. of the entire force in the course of 25 hours. Then there would be a slow drop until within about an hour of the time when the battery was nearly exhausted, and then the current would come down very fast—you could almost see the lights fall; this is a point to which you should never let the battery get, if you want to take care of it. By having a small hydrometer floated in the acid liquid of the battery, and observing it from time to time, you can tell whether your battery is well charged or not.

Mr. Greenough—Does it take long to charge those batteries?

Prest. Morton—Yes; because we cannot charge them even as fast as we can discharge them. For example, it will not do to discharge one of these ordinary batteries at a faster rate than 30 amperes, and at that rate we can discharge them in 10 hours. One of these batteries should contain about 300 ampere hours; but in charging them you must not use a current higher than 20 amperes, consequently you must spend 15 hours in charging them at this rate.

Mr. Vanderpool—What determines the rate of discharge of the battery? How is that regulated? Suppose it was 30 amperes, and you put on more light?

Prest. Morton—You must not put on more lights. The battery can be discharged in a minute—not that you will very perfectly discharge it then. It is found if you make a close circuit you will get a tremendous discharge,

and the charge will be apparently gone; but if you let the battery stand awhile you can get another discharge out of it. The explanation of this is, in the sudden action, it is only the particles on the surface that act. Such treatment, however, injures the battery.

Mr. Greenough—If you use a small number of amperes could you use an arc current?

Prest. Morton—Oh, yes; there is no objection to using an arc current. In fact, you have to use a pretty intense current, because it is usual to charge these batteries in series. Then the resistance is sufficient to make it desirable to use an arc current. Of course, the question of the electromotive force of the current and its quantity is one that is controlled by the battery. If you use too great an electromotive force you will put too much through your battery; so that the capacity of the battery limits the electromotive force you can use upon it. For example, suppose you had a current directly from the Brush machine with nothing else in the circuit. Now, you put one of these batteries in such a circuit and it will burn the plates. To save the battery, in order that it may not be injured by the current, you must have it arranged to receive only a limited current; for example, it may take the place of an arc light. One of these batteries may take the place of one or two arc lights in a series, and then it will only take its share out of the whole electromotive force of the circuit. That has been frequently done.

Mr. Vanderpool—Suppose you had half a dozen different houses with batteries in, and attempted to charge them on an arc wire?

Prest. Morton—Then you would charge them in series, and each battery would take the place of one or two arc lamps.

Mr. Vanderpool—Suppose one battery was exhausted and the other was full?

Prest. Morton—They would take the same amount of current. In the one that was full the hydrogen and oxygen would escape. When a battery is run down and you begin to charge it there is hardly any escape of gas. When fully charged, then all the gases developed by a charging current escape. To continue charging would be throwing away your current, because you would be causing it to decompose water into the gases which escaped. You would be storing, in the sense of turning electric into chemical energy; but you would be throwing this chemical energy off into the atmosphere.

There is one other point connected with the general subject I will mention which will interest you, and that is with regard to the durability of electric lamps. You know a great many tests have been made, and it has been shown that good electric lamps will last 1,000 hours, on an average; but it is not so well known generally that that does not mean 1,000 hours of 16-candle power. On the contrary, after a lamp has been in use for a certain number of hours—and sometimes for only one or two hours—with exactly the same current, it will not give anything like the same candle power. The tests made at Philadelphia in 1884 showed that even for the Edison lamp, which gave the best results of all the varieties tested, 1,000 hours was a very much longer time than a lamp would burn at its full original 16-candle power. It showed that most of them, after burning 1,000 hours, would give only half their original candle power with the full current, and at 500 hours the average was about 60 per cent. of their original candle power. I have frequently noticed, in offices and stores, electric lights burning which were not more than 8 or 10-candle power, and I have not the least doubt but that they were 16-candle power when put in. When such a lamp has fallen to 10 or 12-candle power it is still taking just the same amount of electric current to run it as at first. The change is due to a molecular change in the carbon filament, by reason of which the current is unable to produce a corresponding amount of light.

Mr. Greenough—Do you think that the battery manufactured in Newark will be a success?

Prest. Morton—I really think it is. It will be an expensive thing for a long time, if not always; but aside from that it is, I believe, a success, and will have a large use.

Mr. Greenough—You say that if you turn a current of Brush light on a battery it would burn it up?

Prest. Morton—Yes, if there were no other lamps in the circuit, and if the current was not controlled.

Mr. Greenough—I thought that in the Brush series each lamp required an electromotive force of about 50 volts; and if they had on 40 lamps, then there would be 2,000 volts.

Prest. Morton—If a machine is automatically adjusted it will not give any excessive current, even if only a few lamps are in circuit. In other words, the ordinary Brush machines are arranged to give a current of about 10 ampéres. If anything happens so that any more current than that would tend to be produced, an automatic arrangement checks it. Therefore, under those circumstances, you could not hurt the battery, because you could not get an excessive current. When I spoke of a current burning a battery I was supposing that you had a full Brush current on the battery with no automatic check.

Mr. Greenough—You said you could put that in a circuit just as you would a lamp?

Prest. Morton—Yes. You see, a battery arranged as we would use it would correspond to an electromotive force for each cell of 2 volts; 25 cells would therefore equal 50 volts. Therefore that would be just equivalent to one lamp. If, however, we desired to use the Edison lamps requiring 100 volts, we would need a battery of 50 cells, which would replace two Brush lamps. These 100-volt lamps would require only half as much current in ampéres to run them as the 50-volt lamps, to produce equal light; so that with 50 cells and these lamps you could have 60 lamps in place of 30.

Mr. Greenough—The current of all the other arc lamps on that circuit would then go through it?

Prest. Morton—Yes; just as the same current goes through all the lamps on an arc circuit.

Mr. Greenough—Will that hurt it any?

Prest. Morton—No; because the quantity of the current is the same at each point. It is as though you had a pipe with a pump forcing water into it; at one point it had to force water up ten feet, at another place ten feet, and ten feet at still another place. Now, take any one of those places and the force that is exerted in raising the water in that place is only ten feet, but the pump may be exerting a force of 100 feet if there are ten of these places, and the amount of water flowing is identical at each point.

Mr. Vanderpool—Suppose that you should cut out three of them?

Prest. Morton—Then the water would flow faster, and more would go through. Suppose each of these pipes was of just such a strength as to stand the first flow, if some of these rising parts or steps were taken away, so that the current would be more violent, it would break the pipes.

There are dozens of batteries which I have not mentioned, but the only important ones are: First, one of M. Julien, who has come to this country in the last few months with a battery and a car. The battery is substantially like the one before us, and its only claim is that it has a non-attackable metal. Second, another inventor in England, named Parker, claims to have a non-attackable metal. This feature of securing a non-attackable metal or alloy for the base of the plates is, of course, a very important one, for on it largely depends the cost of maintenance of the system,

I have detained you longer, gentlemen, than I intended to, and so I will stop here.

[At the conclusion of the lecture President Morton received the members of the Society at his residence, where a most entertaining social seance was held. In passing, it may be remarked that the Director of the Stevens Institute is as clever in the parlor as he is in the lecture room.]

[Prepared for the JOURNAL.]

New Works of the South Metropolitan Gas Company, at East Greenwich, London, England.

By NORTON H. HUMPHRYS.

By the courtesy of Mr. George Livesey, Chairman, and Mr. Frank Livesey, the Chief Engineer of the South Metropolitan Gas Company, the writer recently had an opportunity of walking round the new works now in progress at East Greenwich, and as the design of the same is unique in several respects, especially with regard to extent of productive power, a brief description may be interesting.

This Company, as its name implies, distributes gas to that part of London situated on the south of the Thames. Its district is of an irregular shape, extending, with one or two trifling exceptions, along the south bank of the river from one end of the city to the other—a distance of perhaps 14 or 15 miles; and the width (which varies considerably at different points) averages something less than half this distance. There is a crowded and busy population in the area within a distance of about two miles of the river, but further out the district is of a suburban character, comprising villa residences, etc., gradually thinning out until the open country is reached; and this neighborhood has undergone a rapid increase in the course of the last few years—new roads and rows of villas springing up in all directions. This, together with the wise policy and prudent management which the affairs of this undertaking have always received from the first, causes a rapid increase in the demand for gas, which of course necessitates an energetic extension in the way of productive power.

The wants of the consumers have hitherte been supplied from four or five stations situated on the banks of the river (so commanding water carriage for coal), and at the headquarters at Old Kent Road, which stand nearly in the center of the district; but the necessity for additional plant, demanding more space than that available at either of these stations, which are all closely surrounded by buildings, led to the purchase of a site close to the river at the eastern end of their district, comprising some 96 acres of land, and adjoining the tar works belonging to Mr. F. C. Hills, a gentlemen well known in connection with gas purification. It is about five miles below London Bridge, and four from the Old Kent Road station, with which it has been connected by means of a 48-inch main. The ground is not much bet-

ter than a marsh, having probably at one time formed part of the bed of the river, and consequently it is necessary to go down some 20 feet or so for a fair foundation. A considerable portion of preshore has been reclaimed from the river by the erection of a wall, built of concrete blocks resting on sheet piling, along the whole length of frontage. A good approach walk, with footways, etc., leading up to the offices, is also in progress.

At about the center of the river frontage a jetty is constructed, built of iron, and supported by very massive cast iron pillars. In shape it resembles the letter T, and will take three coal vessels along the front and one in each bay. There are 24 cranes, worked by hydraulic power, having cradles or skips capable of holding one ton of coal each; and there are three lines of railway, ordinary gauge, on which run trucks capable of holding about five tons each. The deck of the jetty is about 35 feet above high water, and as the rise of the tide is 20 feet, the maximum extent of lift is some 60 feet. Each crane is capable of lifting 65 loads per hour, including the transference of the same to a truck, representing a total unloading capacity of 1,500 or 1,660 tons of coal per hour. The steam engines, boilers, and hydraulic machinery are contained in a covered under-deck, and a little glazed cabin is provided for the driver of each crane. From the jetty a viaduct extends in a straight line nearly the whole breadth of the land, and inclined ways are provided so that a low-level service for the transit of coke, purifying materials, etc., can be laid down. On the left are the retort houses, 12 in number, placed broadside to broadside, have a coal store between each two, also one at each end, and a covered branch runs off from the viaduct into each store, so that the coal is conveyed direct into the retort houses. Immediately on the right of the viaduct are rows of buildings for the boilers, exhausters, and pumps; and some distance behind are rows of washers and scrubbers. A vacant space is designedly left between the exhausters and washers, so that in the event of the experiments now being conducted on purification by liquids being successful the same could be adopted without alteration of connecting pipes. Then come the purifiers, comprising 12 sets of 8 vessels each, arranged in double rows with space between for lime or oxide sheds. These rows are laid parallel to the river, and extend nearly to the outskirts, plenty of room being left for the meters. Returning to the left hand, at the back of the retort houses is a large space available for a coke ground, and beyond this is the gasholder ground, having accommodation for five gasholders, each to contain 8¼ million cubic feet of gas.

The whole of this scheme is not to be carried out at once, but the object is to be able to erect section by section as it is required. At present one limb of the jetty and a portion of the viaduct is actually constructed, and the river wall is in a forward state. One retort house is complete and ready for use, also the foul main and condenser. The boiler house and exhauster house (which will serve for four sections) is nearly completed, having the pumps, exhausters, etc., fixed, and one set, comprising three washers, two scrubbers, and six purifiers; so that if necessary gas could be manufactured at once. Sufficient progress has been made to give some idea of the appearance and working of the whole plan, which provides for 12 separate sections, each capable of producing 5 million cubic feet per day, or 60 million in all. It resembles the Beckton works so far as the dividing into separate sections is concerned, but is totally different in every other respect. The Beckton works are laid out with imposing effect, covering a vast area of ground, and having some regard to appearance both in a general and also in an architectural sense; but here, whilst everything is markedly strong and substantial, there is no direct attempt to gratify the eye. Consequently, whilst retaining ample working space where it is wanted, these works will only cover about one-half the area of the Beckton works, although their productive power will be fully 50 per cent. greater. There is a striking absence of the usual ornamentations, such as polished capitals and tie-plates, scrollwork in the spandrels, etc., with regard to the ironwork; and the whole of the brickwork is of plain yellow brick. I do not think there is even a plain string course or beading throughout the works, unless it also serves some useful purpose. But they are by no means ugly. The whole is nicely balanced and well proportioned, and conveys a pleasing effect of neatness and appropriateness, which is not lessened in the eyes of practical men by the consideration that the "cost of capital per 1,000 cubic feet of gas made" will certainly be low.

The retort house already completed, is 485 feet long, by 120 feet wide, including a coal store on each side. It contains a row of double retorts, comprising three blocks of 15 beds in each, having ten retorts in a bed, or a total of 450 through retorts. The settings are of considerable height, and the retorts are arranged in five tiers, one above the other. This narrow and high form of setting has been found, by experience at another works, to give very successful results. West's system of drawing and charging by machinery is used, and self-sealing lids on the retorts. The coal is taken in at the ground floor, passed through a breaker, and carried up into an overhead hopper, from which it is delivered to the charging machine as required. The breaking and elevating machinery is worked by a 9-horse power gas engine. The hydraulics are of wrought iron, in separate sections to each bed, and fitted with Livesey and Tanner's arrangement for drawing off the tar, and keeping the pipes sealed in liquor, and which is the only device I have yet seen which really accomplishes this end. The whole of the tar deposited in the hydraulic is run off by separate pipes and conveyed to a tank at a slightly lower elevation, situated outside of the retort house at one end, and from this it can be distributed to barges or to the retort house fires by gravitation. There is a chimney at each end, and also between each section, not rising higher than the ridge of the roof, and each chimney is fitted with an arrangement on the top, devised by Mr. Tysoe, the resident Superintendent, by which it can be partially or wholly closed. This is to be used when the retorts are standing off on Sundays. The retort house is roomy and well ventilated, the coke hole in particular showing a great improvement in this respect. The gas, on being collected from the hydraulic, passes through a long length of 30-inch pipe, carried round the retort house and coal store. The condensers are novel in character, and consist of a massive convolution of 36-inch pipes, which serves as a support for a water condenser, in which the gas passes through a series of narrow V-shaped chambers, between which a current of water is made to flow. By this means the temperature of the gas can be nicely regulated. A pair of exhausters, driven by a direct acting horizontal engine, are provided for each retort house. Each exhauster house will contain six sets, four for regular work, and two to act as duplicates when necessary. The washers are of the Livesey type, the construction of which is well known. A series of tanks situated below the viaduct, afford ample storage for liquor. It was found necessary to excavate to a great depth to get a good foundation for this structure. By simply connecting the brick piers with party walls, excavating out the earth, forming a sound bottom, and rendering the whole with cement, ample storage room was provided at a cheap cost. After the washers the gas passes through two scrubbers in succession, and here it is treated with a larger quantity of clean water than is the usual practice. Mr. Frank Livesey sometimes uses as much as 30 gallons per ton of coal carbonized, and finds that this plan greatly improves his working results. The purifiers consist of a row of eight vessels, each 30 by 67 feet, constructed on a basis of 400 square feet horizontal area for each million cubic feet of gas. They are not enclosed by buildings, but a traveling roof, large enough to cover one box, is provided, so that the men can work under cover in wet weather. The station meters are sunk in the ground, a rendered brick tank forming the case, and this is covered by an arched iron roof rising above the surface; so there is no expense for meter houses.

One of the gasholders is now in process of erection. It will be the largest gasholder in the world, having a cubical content of 8¼ millions cubic feet of gas. The diameter is 250 feet, the height is 175 feet, and it comprises four lifts. The curbs and outer sheets are constructed of steel plate, and the roof, which is untrussed, rises 20 feet in the center. The curve of the dome is flat in the middle and more rounded at the outside. The guide frame comprises a large number of wrought iron columns and diagonal framing, and the whole is a development of the principles followed by Mr. George Livesey in the designing of his celebrated gasholder at old Kent road. The tank is 254 feet in diameter and 45 feet deep, the top edge standing 15 feet above ground level. It is built of concrete, and there is an inner wall 156 feet in diameter, springing from about half way up the side of the dumpling, also built of concrete. So the tank is really annular, a considerable space being left dry in the center, whilst the inner wall acts as a support to the timber framing which is necessary for the support of the roof. It will be observed that the storage capacity is small as compared with the producing power, and the reason of this is that the old Kent road station, which is centrally situated for distribution, is to be used more as a storage station.

The contractors for the ground and building works, including tank, are the well-known firm of Messrs. Docwra & Co., of London, and Messrs. Ashmore, Benson, Pease & Co., of Stockton-on-Tees, have the holder in hand. Messrs. Cutler, of Millwall, have erected the purifiers, and the exhausters and engines are made by Messrs. B. Donkin & Co., of Bermondsey. The design of the whole is the joint production of Messrs. George and Frank Livesey, and they are being carried out under the superintendence of the gentleman last named. These eminent gas engineers are to be congratulated upon the progress already made in this their latest achievement. Every visitor to this new works will be struck with the appropriateness of each part for its intended purpose, and with the evident fact that in each appliance a maximum of reliability and efficiency has been secured at a minimum cost.

Senator Worth's Bill to Create a Board of Gas Commissioners for the State of New York.

Senator Jacob Worth, who represents one of the Kings county districts in the present legislative assembly of this State, is the putative sponsor of a bill to place the gas companies of New York under the control of a State Board of Gas Commissioners. The following is a report of the text of the measure:

SECTION 1.—Within ten days after the passage of this act the Governor, by

and with the advice and consent of the Senate, shall appoint three citizens of this State, who shall constitute a Board of Gas Commissioners, who shall have control of all corporations engaged in the manufacture of and sale of gas used for the purpose of illumination, and he shall also designate the chairman thereof. Said Board shall appoint a secretary, who shall keep a full and faithful record of its proceedings, and shall serve such notices and perform such other duties as the Commissioners may require, and who shall, before entering upon the discharge of his duties, be sworn to faithfully perform the same.

SEC. 2.—One of said Commissioners shall be appointed for one year, one for two years, and one for three years, and annually thereafter the Governor in the same manner shall appoint as herein provided one Commissioner to serve for three years from the date of his appointment, and until his successor is appointed and has qualified. If a vacancy occurs by resignation or otherwise, the Governor shall in a like manner appoint a Commissioner for the residue of the term, as hereinbefore provided. Any two of said Commissioners shall constitute a quorum for the transaction of business, and may hold meetings at any time or place within the State.

SEC. 3.—Said Commissioners shall be sworn to the faithful performance of the duties of their respective offices before entering upon the discharge of the same; any person in the employment of, or who owns any stock in a gas corporation, as aforesaid, or who is in any way directly or indirectly interested pecuniarily in the manufacture or sale of any material used by such corporations, shall not be eligible for appointment to nor to hold the office of Commissioner.

SEC. 4.—The annual salary of such Commissioner shall be five thousand dollars, to be paid quarterly from the treasury of the State. The annual salary of the secretary shall be twenty-five hundred dollars, payable quarterly from the treasury of the State. Said Board shall also have power to employ such additional clerical force, not exceeding in number three persons, however, at salaries not to exceed in the aggregate the sum of three thousand dollars per annum, as it may find necessary for the purpose of preparing the reports required by this act, and such other clerical duties as may be required of them by said Board. Said Board shall also have power to employ experts temporarily whose services it may deem to be important in any investigation herein provided. In the discharge of the duties of their office transportation shall be furnished them, and they shall have procured for them, by the State, the necessary books, stationery, and statistics incidentally necessary for the discharge of the duties of their office, and they shall have reimbursed to them quarterly the expenses and disbursements they may have necessarily incurred in traveling, and the necessary travel expenses and disbursements of their clerks and experts, and a statement of such expenditure in detail shall accompany the annual report. The salaries and expenses authorized by this act shall be audited and allowed by the Controller, and paid in the first place by the State Treasurer upon the order of Controller out of any appropriated funds from time to time remaining in the treasury. The sum of thirty thousand dollars, or so much thereof as may be necessary, is hereby appropriated to carry out the provisions of this act. The Commissioners shall be provided with an office in the Capitol, at the city of Albany, in which their records shall be kept.

SEC. 5.—The annual total expense of said Board of Gas Commissioners, including salaries for commissioners, clerks and experts and additional clerical force, printing of reports, and all other expenses incident to said Board excepting only rent of offices, shall not exceed the sum of $30,000.

SEC. 6.—The annual expenses of the Commissioners and secretary, including salaries, shall be borne by the several corporations affected by this act in proportion to their paid up capital, and shall be assessed and recovered in the manner provided for the assessment and recovery of the expenses of the Railroad Commissioners.

SEC. 7.—Every such company shall annually make a return to said Board in a form and at a time prescribed by said Board, setting forth the amount of its authorized capital, its indebtedness and financial condition on the first day of January preceding, and a statement of its income and expense during the preceding year, together with the account of its dividends, paid or declared, which shall not exceed the rate of 10 per cent. in any one year. Every such company shall also at all times, on request, furnish any information required by the Board concerning the condition, management and operation of the company, and shall comply with all lawful orders of said Board.

SEC. 8.—All net earnings derived from the business of any such company, over and above the cost of conducting the same and the payment of dividends above provided for, shall be applied to the reduction of the price of gas sold to consumers for the succeeding year.

SEC. 9.—Said Board shall have the general supervision of all corporations engaged in furnishing illuminating gas, and shall make all necessary examinations and inquiries and keep themselves informed as to the compliance of the several corporations with the provisions of the law.

SEC. 10.—Upon the complaint, in writing, of any consumer of gas furnished by such company, of the quality and material sold and delivered by such company, the Board shall notify such company of such complaint by leaving at their office a copy thereof, and shall thereupon, after notice, give a hearing to such petitioner and such company, and after said hearing they shall make such orders and take such action as may be necessary thereto, and a report of the proceedings and the result thereof shall be included in their annual report to the Legislature.

SEC. 11.—The Commissioners shall, from time to time, examine and test the gas furnished by the companies for illumination, and if after said examination any change as to quality of said gas is in their opinion necessary they shall notify the proper company, and shall thereafter give said company a hearing and proceed as in the last foregoing section specified.

SEC. 12.—The Board, whenever any such company violates or neglects in any respect to comply with the provisions of any law, or refuses or neglects to comply with any lawful order of the Board, shall give notice thereof in writing to such corporation. Any person or corporation thereafter refusing to obey the legal order of the said Commissioners shall be liable to a penalty of $100 for each refusal. The Board may also present the facts to the Attorney-General, who shall take such proceedings thereon as may be necessary for the protection of the public interests.

SEC. 13.—The Board shall make an annual report of its doings to the Legislature in January, with such suggestions as to the condition of affairs or conduct of the companies as may be deemed appropriate.

SEC. 14.—No such company shall hereafter issue any bonds at less than par value, nor increase its capital except for construction, unless approved by said Commissioners, etc. The proceeds of all funds or stocks hereafter issued shall be applied to the payment of obligations incurred for the enlargement and extension of the works, and the purchase of real estate for the use of the company, or for the payment of liabilities existing at the time of the passage of this act.

SEC. 15 —All acts or parts of acts inconsistent herewith are hereby repealed.

SEC. 16.—This act shall take effect immediately.

Rules and Regulations Relating to the Use of Gas Machines.

In response to several inquiries we herewith republish the rules and regulations, adopted by the New York Board of Underwriters, to be observed by insurance companies of this State in their dealings with those who employ gas machines. Mr. D. A. Heald, of the Home Insurance Company, assisted by Messrs. Coit, Ogden, Adee, Nestell, and Oakley, drew up the rules, and the following is a copy of their report:

Your committee, having carefully examined the subject submitted to them, beg to present for your adoption the following rules and regulations in regard to subject under consideration, and to suggest that this Board decline to give its approval to any gasoline gas machine by name; but if upon submission to said Board, or its experts, such machine is found to conform strictly to requirements hereinafter mentioned, a certificate to that effect will be issued by said Board upon the manufacturer signing an agreement stipulating that each machine erected or placed by him or through his agency shall, in every way, conform to the rules and regulations of this Board as to construction, location, and arrangement.

1st. That the vault or gas house shall be placed at least 30 feet from any insurable property.

2d. The machine and all the apparatus shall be made of good material (copper being recommended as the best and safest), and in a substantial and workmanlike manner.

3d. That the generator or any apparatus containing gasoline or other inflammable fluid, or any gasholder, shall be placed in a vault outside the building or premises to be insured, and not less than 30 feet distant from any insured property.

4th. Stopcocks must be placed on both the gas and air pipes near the generator in the vault, and also on the gas pipe where it enters the building and on the air pipe near the air pump, when the pump is in the cellar or building.

5th. The vent and filling pipes shall be so arranged that one cannot be opened without opening both.

6th. In case the air pump of a machine is placed in the cellar of the building an automatic check-valve shall be inserted in the air pipe to prevent the backward flow and escape of gas or gasoline through the pump into the building; and the pump shall be so constructed and set that the air supplying it is drawn through a pipe leading from without the building, and rising at least one foot above the ground; provided, that where machines of not over 50 lights capacity are used without the aid of artificial heat of any kind, and are provided with an automatic check-valve, as above called for, the air inlet-pipe from outside of the building to the pump or blower may be dispensed with.

7th. In all cases where the air pump or blower of any machine is located within a building such pump shall be provided with an outgoing pipe for carrying air to the generator, and a returning pipe for conveying gas from such generator to the premises to be lighted.

8th. Whenever hereafter it is necessary to apply artificial heat to the "generator" or tank containing gasoline or other inflammable material, such heat shall not be applied directly to the generator or its contents by steam pipes, or any method other than by heating the air as it passes from the pump or blower to the generator by the introduction of a steam pipe within the air pipe, such steam pipe to be carried through the air pipe to a steam trap inside of the vault surrounding the generator, or to a point distant at least 5 feet from the generator, and from thence be brought to the surface of the ground.

In case an apparatus already in use, arranged to utilize artificial heat in any manner other than as above provided, cannot conveniently be made to conform to the above requirements, the generator of such apparatus must then be provided with a safety valve weighted to open at a pressure of not over one-half pound to the square inch; or in lieu of this the whole apparatus, including the pump or blower, must be placed outside of the building, and not within 50 feet of any insurable property.

9th. Where machines or apparatus are used in which the gasoline or other inflammable material is vaporized by artificial heat after leaving the reservoir or tank, the whole apparatus must be placed at least 50 feet from any insurable property, and be connected with the building to be lighted by gas pipes only.

No "mixer," "equalizer," or other apparatus, attachment, or appliance in which gas is held for dilution or enrichment shall be located within the building to be lighted.

10th. Retorting gas machines or apparatus, in which gas is produced by fire-heat, must be located outside of the building to be lighted, and not within 50 feet of any insurable property.

11th. All the main gas pipes leading to the premises lighted must have an inclination toward the gas machine, so as to return all condensation that may take place in the pipes.

12th. The premises to be lighted must be securely piped, the pipes thoroughly tested by competent persons before the gas is let on, and the pipes to be so put up as to avoid, as much as possible, an accumulation of any condensation that may occur inside the building lighted.

13th. Particular inquiries are to be made as to the competency of the persons who are to have charge of filling the machine, and to ascertain if they are informed as to the importance of having the vent open and the air pump shut off whilst the machine is being filled with fluid; and of the great danger of using a light in or near the gas house or vault.

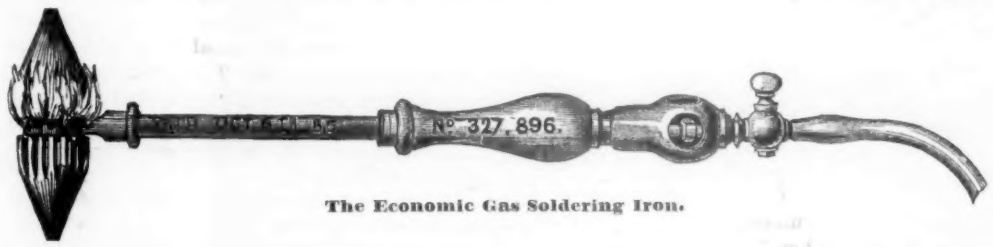
14th. No barrels containing gasoline or other like fluid, or from which gasoline has recently been emptied, shall be allowed to be kept in any cellar, barn, shed, or outbuilding where other property is kept, or where there is a liability to use a fire or light.

These rules and regulations are based upon the experience gained from many years of careful study and investigation, and are promulgated by this Board as constituting a perfect apparatus, without reference to any particular system or class of machines now in the market. A strict compliance with these requirements being essential to the production of an absolutely safe gasoline gas machine, this Board will not hereafter pass its approval on any apparatus which does not conform to the standard herein laid down; and as most of the machines now in use can be changed to meet these requirements at small expense and without dispensing with the apparatus already in place, it is earnestly recommended that all users of gasoline gas machines at once secure such changes as may be necessary to bring such apparatus up to this standard of safety.

Inspectors must be careful to observe that the requirements above noted are fully and literally complied with in all cases, before approving or giving consent to the use of any gasoline gas apparatus, as any machine not conforming strictly to the above rules and regulations will stand condemned and its use be prohibited by this Board. All former rules and regulations in regard to gasoline gas machines, which have been promulgated by this Board, are merged in and shall conform to these rules.

The Economic Gas Soldering Iron.

The Colwell Lead Company, of No. 63 Center street, this city, acting as agent for the "A. Giles Manufacturing Company," offers to the trade the "Economic Soldering Iron," a fair understanding of the general features of which will be obtained from an inspection of the illustration herewith presented. The chief advantages claimed for this tool are convenience with economy and evenness of temperature. A gas pipe, provided with an ordinary cock for turning on or shutting off the gas supply, runs through the wooden handle. The wooden handle and the bits are connected by a large gas pipe, open at the end, for admitting air to mingle with the gas that issues from the smaller pipe, and in consequence it will be seen that the gas is burned under somewhat similar conditions to those maintained in the Bunsen burner. Between the two fluted bits, as shown in the cut, is placed a ring of brass, having a number of perforations in its circumference, through which the gas passes out to be consumed. When the iron is in duty a rubber tube connects it to a gas jet, and the gas feed is regulated or controlled by the cock next to the handle. As revealed by the cut the flame envelops the upper bit, and when the latter is brought to the proper temperature it is ready for the soldering process, while, by the act of reversal, what was previously the under bit becomes the upper section, and the latter is being brought to the necessary temperature during the time that the first is cooling off in the work to which it is devoted. In effect, therefore, a simple reversion of the instrument at the proper moment shows that the iron may be used continuously.

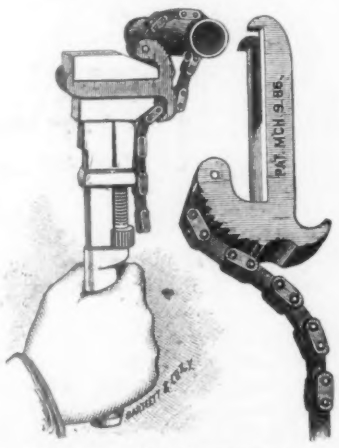


The Economic Gas Soldering Iron.

This particular sort of tool is also made with a single bit, which is heated by a gas flame in the same general way. When desired hatchet bits are provided, either singly or in pairs, attached similarly to the fluted bits described. By the use of these irons no furnace is needed; all that is necessary being a gas jet within reasonable distance of where the work is done. It will be seen that one of these double irons serves the same purpose as two ordinary irons, for one bit is always being heated while the other is in use. It is stated that the consumption of gas by these soldering irons is only one cubic foot per hour, and that a cold bit can be heated ready for use in three minutes. The simplest way of holding the iron when in use and for first heating is to rest it in a block of wood about 4 inches square, with a V-groove in it large enough to hold the pipe. The Economic Soldering Iron has been used for some time in Europe, and a number of testimonials to its merits are given by English stained glass workers and others.

Pipe Wrench Converter Attachment.

The pipe wrench attachment herewith illustrated is being put on the market, as a novelty, by the Armstrong Manufacturing Company, of Bridgeport, Conn. It constitutes a pipe wrench attachment for monkey wrenches, and, being made of forged steel, is not only light, but strong and durable. It changes a monkey wrench into a device for round surfaces in the shortest



Pipe Wrench Attachment.

possible time. The present size manufactured by the Company is calculated for 10-inch wrenches, and pipe capacity ranges from ¼ to 1¼ inches. The operating principle is similar to that of the chain-tongs. Samples, sent by registered mail, will be forwarded to any address by the Company on receipt of $1.20.

Notes from the West.

By Retort.

"The electric light has come to stay!"

Certainly; so has $ gas.

The recent issues of the various gas journals contained matter that must have proven exceedingly palatable reading to the benevolent manufacturers of electric apparatus. One would suppose that a universal scramble for electric plants was in progress, and that the time was now here when consumers could obtain quotations from the "Light Office" for arc or incandescent electric, or plain, but far superior, gas illumination; and that gas engineers who did not "hustle" to get into the combination scheme were in danger of being "left." Is there not a suspicion that there lurks behind this whole matter a shrewd little boom for the benefit of the manufacturers of electric light apparatus, and that the real interpretation is, "The (boom of the) electric light (manufacturers) has come to stay?"

Apparently the electric boom is superseding the water gas boom. A quarrel seems imminent between some of the supposed gas journals as to which *discovered* the combination scheme! It reminds one of the next issues of local papers after a reduction in gas rates; each claims the honor of doing it, while withering editorials denounce the contemporary for his mercenary shielding of the octopus gas monopoly. The gas engineer could probably tell you that a reduction would have been made long before were it not for the anatomical display of the editors.

Now, our gas journals coolly inform us we must hustle on the fence, so as to cover both sides of the question, and dispense both kinds of light. In other words, we must "eat crow," and that as speedily as practicable. It is small wonder that the pioneer Gas Light Journal was slow to "come over," as a rival journal so gleefully puts it. The chasm was a terrific one to cross. All the teachings of recent years, by the brightest lights of the profession, must thereby be ignored; and above all, to "come over" means that the prime leaders of gas intelligence—the editors of all the journals—themselves must thereby stand self-confessed as cruelly mistaken, or, worse still, blinded by a loyalty to the industry of gas lighting. The gas man is bewildered by the rapidity of the evolution. What has brought it about? It is no argument to say, "The electric light has come to stay." Of course it has; and so has water gas; but we are not running over each other in our desire to secure a water gas plant. We are fami'iar with the singular anomaly of water gas people operating coal gas plants. This proves the *staying* qualities not of paramount importance.

The question is not, "Has the electric light come to stay?" but "Has it come to *supersede gas?*" Convince the gas men of the country of the latter, and the manufacturers turning out electric apparatus could run night and day for years and still have unfilled orders. The rush for plants would be tremendous. Now, we may be mistaken, but we do not remember to have seen any arguments used in the gas journals regarding this matter except that "the tendency of the times seems to point toward combination," and that "the electric light has come to stay." Surely these are very meager arguments to advise so important a change upon.

How about the profit upon the investment? We are told the gas companies can operate an electric plant, in connection with their gas plant, for much less money than an independent electric light company. Undoubtedly this is true; yet we have been told, by several shrewd gas engineers who are now operating gas and electric plants combined, that *there is no money in the electric light*, but that it pays because it saves annoyance.

Investigation proves that, taking a period of two or three years' business, very few electric companies are making money—certainly nothing like the profit reaped in our own business. When you find an electric light company making and declaring fair and regular dividends, investigation wi'l disclose some unusually favorable circumstance which accounts for the showing.

For instance, we know of a company furnishing arc lights at $60 per year for street lighting, while only a few hours' ride brings us to another company that furnishes the same light at $200 per year. Is it any marvel that the latter company makes money? Yet the engineer in charge of the former (both plants use gas and electricity combined) says it saves his company annoyance, and hence pays.

If the present boom is resting upon future improvements in electric apparatus we shall want to go slow. Nor is it enough to know that one or two prominent gas engineers have embraced the new faith, for dozens, equally wise, cling to their old creed until the new is proven to be a better.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In Charge at Winfield, Kansas.—Mr. Geo. B. Burns, former lessee of the Princeton (Ills.) gas works, is now located at Winfield, where he acts as Engineer and Superintendent of the local gas enterprise. The gentleman is ardent in advocating Winfield's claims to future business advance and prosperity. In fact, he writes: "We have a live, thriving, booming city out here, and I am more than in love with it." Mr. Burns is shrewd and energetic; and we are pleased to know that he is so eligibly situated. Kansas coal is carbonized in the Winfield benches, and a yield of 4 feet per pound is obtained from it, no exhauster being used. The latter state of affairs ought to be remedied in short order, and we opine that Supt. Burns would not have great trouble in persuading Prest. Fuller of the economy attendant upon such a purchase.

In re the Philadelphia Gas Works.—On Feb. 3 final action was taken in the matter of the report presented some time since by the Finance Committee of the Philadelphia City Council. The Committee had asked to be discharged from further consideration of the proposal to lease the city gas works, but the Council failed to act decisively in the premises; and, in fact, it was charged that such delay arose from the desire of certain parties to keep the matter in abeyance until after the Philadelphia municipal election (that event occurred yesterday) had taken place, when the leasing project would be revived. However, on the date mentioned the Finance Committee's request "for discharge from further consideration," etc., was agreed to in both branches of Councils. Mr. Wannamaker ought to have credit for defeating the scheme, although it is pretty well understood that the schemers are not dead, but hibernating, so to speak.

To Improve the Plant.—We understand that the directors of the Pittsfield (Mass.) Gas Light Company will make extensive improvements on their plant during the coming season. It is also said that a project looking to the erection of an auxiliary water gas plant is under consideration; indeed, it would appear that the latter has been almost decided upon, because the discussion has approached the stage where the probable allotment of money for the purpose has been stated. We understand that $10,000 will about cover the cost. If they do decide to try the hybrid principle it will be interesting to watch its effect on the succeeding number of State Inspector Hinman's annual report of average candle power. In 1886 the Inspector averaged the illuminating power of the Pittsfield Company's product at 19.4 candles; and we venture to assert that a similarly good showing will not be made if the "auxiliary plan" goes into effect.

Ordered to Stop the Leaks.—At a meeting of the Poughkeepsie (N. Y.) Health Board, held Feb. 4, Dr. Otis presented a resolution—it was subsequently adopted—ordering the Citizens Gas Company of that city "to repair a leak in its holder tank within ten days, under a penalty of $100 fine, and an additional $10 per day for each day beyond said time," etc. We suppose that the managers of gas companies in this State are already posted in regard to the following clause of the Penal Code; but we will, however, venture to repeat it. Section 390 of the Code says: "A person who throws or deposits gas tar, or the refuse of a gas house or gas factory, or any offal refuse, or any other noxious, offensive, or poisonous substance into any public waters, or into any sewer or stream running or entering into such public waters, is guilty of a misdemeanor."

Springfild, Mo., Wheels into Line.—Last December witnessed the completion of the improvements made on the manufacturing plant of the Springfield Gas Light Company. Instead of having said improvements the term "new plant" might better express the situation, for the Springfield folks now possess a complete 8-inch works. A Wilbraham 8-inch exhauster, a set of 10 by 12 purifying boxes, with hydraulic lift for same, and new connections throughout, make a very complete affair of the Company's possessions. On the 1st inst. a new scale of rates was decided upon. The figures are as follows: Gross price, $2.50 per thousand; but payment within six days from time account is rendered secures the following rebate: A consumption per month running from 400 to 4,300 cubic feet, 5 per cent. off; 4,400 and 20,000 cubic feet per month, 10 per cent. off; 20,000 cubic feet and upward per month, 15 per cent. off. From the above it will be seen that no discount is allowed unless the monthly consumption figures up to at least 400 cubic feet. The prior gross charge was $3 per thousand. The officers of the Springfield Company are: President, L. H. Murray; Vice-President, G. A. C. Woolley; Sec., Treas., and Supt., J. S. Ambrose. Mr. Ambrose ought to be a tolerably busy man.

Cheaper Gas for St. Paul, Minn.—Mr. Ed. I. Frost, the wideawake Treasurer of the St. Paul Gas Light Company—he who last fall renounced the tenebrose ranks of the bachelors by joining the aureate roll of benedicts—has given proof that that corporation desires to keep pace with

the procession. We arrived at such conclusion upon reading the following circular, which bears an imprint of Mr. Frost's signature. The circular is dated Feb. 1, 1887. "On and after April 1, 1887, the price of gas delivered by the St. Paul Gas Light Company will be $2 per thousand cubic feet, with the following discounts on all monthly bills paid at the office of the Company on or before the 10th day:

Monthly Consumption.	Discount.	Net Rate.
5,000 cu. ft.	5 per ct.	$1.90
5,100 to 15,000 cu. ft.	10 "	1.80
15,100 to 40,000 cu. ft.	12 "	1.76
40,100 to 80,000 cu. ft.	20 "	1.60
Over 80,000 cu. ft.	25 "	1.50

Gas supplied to move gas engines will be charged for at the lowest net rate.

LOST AND FOUND.—Mr. and Mrs. Emerson McMillin, of Columbus, Ohio, have lost their charming daughter, Miss Mary Adelaide; but the friends of the "stricken parents" need not give way to woe over the matter, for the loss is merely a question of name instead of in fact. What proved loss to the McMillin household, however, turns out to be gain to the erstwhile monotonous domicile of the Secretary of the Ohio Gas Light Association—Mr. Irvin Butterworth, also of Columbus, Ohio. The marriage was celebrated at Columbus on date of 1st inst. Still another case of Hymen's magic, in that that roguish rover can convert loss into gain, is afforded in the example furnished by certain marriage ceremonies performed at Indianapolis, Ind., on January 28th last, whereby Miss Minnie Dildine became the wife of Mr. J. W. Cowdery. The groom, it will be remembered, is Superintendent of the Jackson (Miss.) Gas Light Company.

Congratulation in either case is unnecessary; but let us hope that prosperity in its fullest measure will be the portion of the contracting parties.

NEW GAS COMPANY.—Messrs. Wm. Budge and Alexander Griggs contemplate the erection of gas works in Grand Forks, Dakota Ter. Grand Forks is the capital of county similarly named; is located on the Red River of the North, at a point about 25 miles west of Crookston, Minn.; and has a population of between four and five thousand inhabitants.

TO BE ABSORBED.—Arrangements have been perfected whereby the American Gas Company, of Phila., Pa., will assume control of the Elgin (Ills.) and Canton (Ohio) gas works. The Elgin plant will be absorbed in March, Canton following suit in April. The Canton purchase ought to be an extremely valuable one, for it is peopled by those who are thoroughly abreast of the times.

ANNUAL ELECTION AT DELAWARE, OHIO.—At the annual meeting of the stockholders of the Delaware Gas Light Company the following directors were chosen: Messrs. T. C. Jones, C. Hills, V. T. Hills, U. Little, and J. M. Kirby. At the subsequent meeting of the Board organization was thus effected: President, T. C. Jones; Vice-President, C. Hills; Secy. and Supt., C. M. Converse; Treasurer, The Delaware County National Bank.

PRICE CHARGED FOR "CARBON POINTS."—The *Electrician* says there are nine large companies engaged in the manufacture of carbons in the United States. Seven of these have recently entered into a mutual agreement respecting the price of their wares, and have issued a joint circular to their customers. The prices agreed upon are quoted, per thousand feet, as follows: $\frac{7}{16} \times 12$-inch, at $12; $\frac{1}{4} \times 12$-inch, at $15; and $\frac{1}{8} \times 12$-inch, at $25; shorter lengths and odd sizes in proportion, plus a stated percentage.

DEATH OF MR. CHRIS. OLSEN.—Gas men in the South and West will hear with regret of the death of Chris. Olsen. Deceased followed the apparently prosaic occupation of a master mason, his specialty being the setting of benches; but, prosaic or not, his work was a guarantee of his honesty and skill; and his career through life was that of a Christian gentleman. Deceased came to his end, on first inst., in Indianapolis, Ind., after a month of racking illness.

CHANGE OF MANAGEMENT.—Mr. Carroll Collins has succeeded Mr. James G. Miller as Manager, Secretary and Treasurer of the Green Bay (Wis.) Gas Light Company. Mr. Collins, however, retains his connection with the Murfreesboro (Tenn.) works. Mr. Collins has purchased a controlling interest in the Green Bay Company from the former proprietor, Mr. Samuel D. Hastings, Jr.

A QUEER EXPLOSION.—On the evening of February 8th the steamboat Jno. P. Thorn was lying to at the wharf at the foot of Third street, Pittsburgh, Pa., and everything seemed to be serene; but the serenity was short lived, for, without warning of any sort, a violent explosion occurred, and the steamer was enveloped in a sheet of flame. It seems that one of the large conduits employed in conveying natural gas across the bed of the Allegheny river is located close by the Third street wharf, and it has since been assumed that a fracture in the pipe permitted an escape of gas which finally found its way to the furnaces of the steamer. Hence the rumpus. The captain and engineer (brothers respectively named Henry and Tillman New) were severely burned, and the vessel sustained damage amounting to $500.

NOT QUITE SO DOLEFUL.—In our issue for January 3d, current year, appeared a letter from Mr. Robt. Bruce, Secretary of the Olympia (Wash. Ter.) Gas Company, that was rather doleful in tone; but the following "notes," sent to us by "B," of the Walla Walla (Washington Territory) Gas Company, are in somewhat livelier strain. "B" thus discusses the situation: "Washington Territory having made its debut in your columns, perhaps some of your readers may be sufficiently interested in the premises to afford it another hearing. This time it shall be about the 'Inland Empire,' instead of 'down by the sounding sea;' and the change of venue may be classified under the title of 'Wheat vs. Clams.' Spokane Falls is a thriving young city, containing about 4,000 population, situate on the Northern Pacific Railroad, 374 miles eastward from Portland, Oregon—the metropolis of the Northwest. An unlimited water power is the boast and principal basis of prosperity of this inland city. This power is at present partly utilized by flour and lumber mills, and furniture manufacturers; and, last but not least, by an electric light company, which supplies the 'half arc' and 'whole' incandescent lamps. With all these, however, the people were not happy; and because they could not claim full metropolitan attainment without a gas works. So the city fathers have not hesitated to grant a gas franchise to the first aspirant for same. One precocious youth seemed about to gratify their longings. Having obtained possession of a 'lot,' he purchased brick, etc., and proceeded to erect the required buildings, the walls whereof now stand at an altitude of ten feet. He caused a forty-foot hole to be sunk, and then, as some of the 'friends' wanted a little coin to meet current expenses, he incontinently skipped out (of the town, not the hole), and about $3,000 worth of creditors 'mourned man's folly.' Meanwhile Spokane continued to expand, and the 'long-felt want' remained unsatisfied. A Walla Walla man, possessed of some gaseous ideas, asked the privilege of competing with the electric light promoters. At the same time an ex-railroad man, and some other capitalists resident in Spokane, concluded that the gas business might pay; and, thinking thus, asked why should an outsider be allowed to get a good thing while they were about? The authorities wrestled with this problem for some two moons, and finally settled it by granting to both applicants the privileges sought for. In the bargain the minimum charge for gas was fixed at $4 per thousand cubic feet. And now came along Messrs. McDonald & Co., of Cincinnati, Ohio, who proposed to erect a gas works, and offered to supply private consumers with a 16-candle power gas at a rate not to exceed $3 per thousand, also agreeing not to charge large customers more than $2.50 per thousand. Street lamps were to be supplied with gas in consideration of the payment of $2.50 per lamp per month. Their proposition took the fort by storm, for at the next meeting of the Council the previously adopted ordinances were repealed, and McDonald & Co. carried off the prize. So, another gas light will soon shine in the far West.

"Query for information. Do electric lighting companies—those engaged in *selling light only*—ever pay legitimately-earned dividends? We know that manufacturers and promoters must make money; but do local investors?"

ANNUAL ELECTION.—At the annual election of the Evansville (Ind.) Gas and Electric Company Messrs. F. J. Reitz, D. K. Dunkerson, S. Bayard, T. Garrin, W. Heilman, J. Eichel and Jno. Gilbert were elected a Board of Directors. At the organization meeting the officers who served last year were reappointed.

SOMETHING FROM PADUCAH, KY.—Since the purchase of the old Paducah (Ky.) Gas Company's plant, made by Evansville, Ind., capitalists, the business increased to such an extent that the present owners were compelled to build a new eight-inch coal gas works. The plant was constructed under the supervision of Mr. Isaac C. Baxter, Engineer of the Evansville (Ind.) Company, through whose courtesy we are enabled to place the following particulars before our readers. The new Paducah retort house contains one bench of sixes, the retorts of which are $16'' \times 30'' \times 10$ feet, and equal to a carbonizing duty of 2,000 pounds of coal each 24 hours. There is a supplementary bench of threes, the construction of which permits its subsequent alteration to a bench of sixes, equal to burning off 1,000 pounds of coal in 24 hours. The retorts, etc., were supplied and erected by the Parker-Russell Company, of St. Louis, Mo. Other plant items comprise a set of annular condensers and scrubbers; an 8-inch Smith & Sayre exhauster with Greenfield engine; and a set of four 9-feet square purifiers. The station meter, gauges, and Foulis governor were furnished by Helme & McIlhenny, of Philadelphia, Pa. A contract for the erection of a new 70,000 cubic foot capacity holder has been awarded to Messrs. Deily & Fowler, of Phila., Pa., and it will be ready for use by next May. The works are quite ornate in external appearance, and the grounds enclosing them are tastefully laid out.

In fact the establishment is now one of the features of the city. At the last annual election the stockholders designated Messrs. Jno. Gilbert, R. K. Dunkerson, F. J. Reitz, J. Cobb, C. Reid, Isaac C. Baxter and L. Lowenthal a Board of Directors, Mr. Gilbert having subsequently been chosen President. The Superintendent's berth is filled by Mr. H. H. Meyers, who for years had been in the employ of the Louisville (Ky.) Company. Before the Paducah Company changed hands it was in pretty bad odor with the people of that city, but the business-like course of those now in control of its fortunes dissipated speedily the prejudice of former days. To prove this we have only to mention that the city recently entered into a contract with the Company, the latter agreeing to light 245 public lamps, for four years, at the stated price of $22.50 per lamp per annum. Prior to the making of that contract Paducah had been without gas in her street lamps for several years. Further, the number of consumers now on the ledgers of the Company is twice as large when compared with the showing made by the final account books of the former owners. Virtue, we are told, carries its own reward, but the best reward of the business man is gained by a strict adherence to business principles.

Furbishing up at Kansas City, Mo.—The Kerr-Murray Manufacturing Company, of Fort Wayne, Ind., is under contract to furnish wrought iron roof, beams, cast iron floor and elevator for the new retort house—the dimensions of the latter being 67 by 100 feet—now in process of construction by the management of the Kansas City Gas Light and Coke Company. The same contractors will also furnish that Company with all the wrought and cast iron work necessary to equip a stack of 18 benches of sixes, to be fired on the regenerative principle; also one set of four cast iron purifying boxes, 16 feet square, with 16-inch connections.

Re-elected.—Mr. Thos. F. Rowland, at the annual meeting of the Society of Civil Engineers, was re-elected to the Vice-Presidency of that body. The Membership of the Society has reached the imposing total of 1,019.

The "Exclusive Franchise" was Sustained—We learn that the case of the Springfield (Mo.) Gas Light Company against the Springfield Electric Light Company was decided (on Jan. 26th, by Judge Hubbard, of the Circuit Court) in favor of the plaintiff. In 1874 plaintiff was granted an exclusive franchise for furnishing lights for street illumination for a period of 20 years. About a year ago the City Council contracted with the defendant to furnish 40 electric lights, to be properly distributed throughout the city, for the purpose of illuminating the public thoroughfares. The contract was to last for three years, and the contractor was to receive an annual payment of $4,137. The Gas Company immediately took steps to enjoin the city from paying any moneys on account of the bargain. An injunction was issued in restraint, and Judge Hubbard now decides that the injunction must be made permanent. The electricians have supplied the lights for over a year, but have not received a payment. They will take an appeal.

New Holder for the Pittsburgh (Pa.) Gas Works.—The Pittsburgh Gas Light Company has determined to put up a new telescopic gasholder. It will have a diameter of 100 feet, and two lifts, each of 28 feet. The Kerr-Murray Manufacturing Company will build it.

Charter Extended.—After some delay and quibbling the Delaware State Legislature finally agreed to extend the charter of the Wilmington Gas Light Company, in accordance with the terms proposed in the prayer of the petitioner.

Ordinances, and no Mistake.—The following is a literal reproduction of an "official copy" of an ordinance proposed by the City Council of Eureka Springs, Ark.: "Sub. 52 Gas Light Companies.—For each gas light company engaging is the business of furnishing gas light to the city or its inhabitants, $50 per annum, for business not to ezeed $10,000 and $5 for each additional $1,000 over $10,000."

Brother Prichard in Trouble.—On the evening of February 4th two employees of the Lynn (Mass.) Gas Light Company detected a leak in the meter room of the works, and, not satisfied to trust to their noses, one of the detectors struck a match to determine the thing certainly. His attempt was instantly successful and decidedly pronounced; for the news reports say one end of the house was shattered to fragments. Supt. Prichard ordered the gas supply to the town to be temporarily shut off; and as the accident happened at 8 P.M., much inconvenience was occasioned the consumers. The total damage to the Company is estimated at $1,500. The chances are that Supt. Prichard will not have a berth for the "match striker," when the latter is discharged from the hospital where he now nurses his wounds.

Annual Elections.—The Cambridge (Mass.) Gas Company has selected the following Board of Directors: Messrs. D. S. Tyler, Q. A. Vinal, C. C. Allen, W. A. Bullard, H. C. Rand, D. M. Chamberlin and F. M. Stimson. The South Boston (Mass.) Company reports the following list: Messrs. B. Dean, S. Peirce, O. D. Dana, R. J. Monks, S. A. Stackpole and W. Eliot Fette. A dividend of 3½ per cent. was declared. At Manchester (N. H.) the directorate returned at the annual meeting is composed of Messrs. M. Currier, N. Parker, D. Clark, C. F. Warren and G. B. Chandler. In connection with the Manchester list it may be remarked that Mr. C. F. Warren is the only one of those named not entitled to the prefix of "Hon."

Cut Down.—The capital stock of the Ashtabula (Ohio) Gas Light Company has been reduced 50 per cent. It now stands at $25,000.

Almost Ready for Business.—The new plant at Marshall (Texas) is about ready to start on gas manufacturing. Consumers' meters have about all been located, and those interested in the enterprise have reason to be satisfied at the outlook for a fair return on the capital invested.

Verdict for the Plaintiff.—In the case of J. H. Skinner vs. the Boston Gas Light Company, the same having been an action brought to recover $5,000 damages for injuries received by plaintiff in consequence of an explosion of gas at No. 17 Kilby street, where plaintiff was employed, the jury awarded plaintiff the sum of $134.45.

The Cowboy Section Could not Ask for More.—It is reported that Sheriff Hugh Grant (whose chief claims to greatness consist in the possession of a more or less celebrated trotting horse, and the fact that he voted, as an Alderman, against the Broadway horse railroad steal), in company with Wm. Bourke Cockran (whose fame is securely grounded on the basis of having had his name affixed to the steeplechaser owned by his chum, Nolan, the Albany Solon), visited Albany the other day. The significance of the visit may be thus explained. They had in their possession a "little bill," which has since been introduced for passage at the hands of the present Legislalature, the "strong points" of same being intended to compel "all corporations, joint stock companies and associations operating railroads in this State, or engaged in laying telegraph, telephone and electric light wires, or owning *gas pipes* or *other mains*, to hand over to the State, annually all profits which exceed 10 per cent. of their net earnings." The corporations are to report to the Comptroller annually the gross receipts, net receipts and the cash actually invested in the business. When a corporation reports that its income "is less than ten per cent., the officers of the company are to make a sworn statement to the Comptroller, and he is to investigate the books" of the concern, if he has reason to believe that the officers have presented a false report. An additional ten per cent. is to be added if the officers —well, we might just as well put it down so—are caught lying. The computations are to be based on cash investments. If a company refuses for three years to make a "proper report" its charter is to be forfeited, and its franchises are to revert to the State. A delegation from the wilds of cowboydom could hardly ask for anything neater than that proposed by the abovenamed strikers at monopoly. Indeed, were it not for the "singular personal and political purity"—a halo, so to speak—that surrounds, nay, permeates the character of the man who refused to give countenance or comfort to the famous Aldermanic "combine" of 1884, we might be forgiven for suspecting that the Sheriff was inclined to put himself in the market—possibly on joint account with Nolan's chum.

Electric Light in Theaters.—Mr. F. Ross, in a paper read before the Vienna Society of Electricians, said that 30 theaters in Austria and Germany are lighted by electricity throughout. The light in the three theaters of Brünn, Prague, and Carlsbad had been established sufficiently long to form an estimate of its cost from actual practice, and it has been found that one electrical horse power per hour in these three instances is obtained with 8 lbs. of coal, 12½ lbs. of coal, and 37 cu. ft. of gas respectively. The working expenses for 1,000 ampere-hours, at 100 volts pressure, are, in Prague, $6.50; in Brünn, $4.50; and in Carlsbad, $13.50. Sufficiently vague to be thoroughly indefinite!

The Old Pittsfield (Mass.) Gas Company.—It has been rumored that an attempt would be made to secure the privilege of establishing an opposition company at Pittsfield, Mass. The reason therefor ought to be somewhat of a mystery, for, taken as a whole, the present management has done very well for the consumers. Inspector Hinman returns the average lighting value of the Pittsfield gas for 1886 at 19.20 candles, or the best gas sent out by any coal gas company in the State. The net rate charged is $2 per thousand, and last year the total quantity manufactured was 14,276,000 cu. ft.; so the selling rate seems fair enough. The Company was organized in 1854, is capitalized at $62,500, and shrewd valuators say that the present plant could not be duplicated for $80,000. Looking over these facts we fail to see where there is need for a new company, and we also fail to perceive how an opposition combination could see its way clear to reaping either glory or shekels in attacking the present occupiers of the Pittsfield gas field.

What Brother Hunt is Doing at Morristown, N. J.—Supt. H. M. Hunt is "booming" gas matters in the handsomest of New Jersey cities. About the first of the year his directors promulgated a rather novel schedule of rates—we are not certain, either, that the plan is a good one—the leading features of same being the following: Gas supplied to private dwellings is fixed at $2.50 per thousand, but where the monthly consumption exceeds 5,000 cu. ft. a discount of 10 per cent. is allowed. To churches, public buildings, hotels, and stores the ordinary rate is fixed at $2 per thousand, 5 per cent. discount being granted when the monthly consumption exceeds 10,000 cu. ft. Later on it was decided to make special rates for storekeepers who would agree to take gas at a contract price for the year. The storekeepers' schedule was thus made out: A consumption not to exceed 50,000 cu. ft. per annum, total contract charge, $90; 60,000 cu. ft., $108; 70,000 cu. ft., $125; 80,000 cu. ft., $144; 90,000 cu. ft., $162; 100,000 cu. ft., $180. This plan was adopted in order to prevent a see-sawing move in the direction of electric light. Mr. Hunt having completed the conduit substitution on which he was engaged last fall, is much pleased with its operation; and so are his consumers. In November of 1886 the electric light folks commenced supplying a lighting current, and the following figures from the books of the gas company will show the effect exerted by the former on the business of the latter:

Date.	Gas Sendout.	Date.	Gas Sendout.	Increase.
Nov. '85..	903,000 cu. ft.	Nov. '86..	1,162,700 cu. ft.	259,700 cu. ft.
Dec. '85..	959,000 "	Dec. '86..	1,251,400 "	292,400 "
Totals..	1,862,000 "		2,414,100 "	552,100 "

We submit that the figures ought to satisfy Morristown's shareholders. The Morristown Company will make extensive plant alterations in the coming season.

Annual Meeting of the San Francisco (Cal.) Gas Company.—The annual meeting of the stockholders of this company was held on January 18th. The old Board of Directors, with the exception of T. Menzies, who was replaced by J. B. Randol, was re-elected. Mr. J. B. Crockett was re-elected President, and W. G. Barrett, Secretary. From the reports submitted we glean the following: The Company commenced the year without debt, and a good supply of coal. Regular monthly dividends (30 cents per share) were paid, and $62,000 was invested in permanent improvements. The Equitable water gas patents were purchased at a cost of $126,000, and $81,000 has been paid on account of same, the balance ($45,000) to come due in March next. The purchase includes all "improvements and reissues of patents." Works, calculated to produce a daily output of 200,000 cubic feet of the Equitable sort of gas, have been erected at the "Protrero." It is said that California petroleum can and will be utilized in the manufacture. The contract for supplying the public buildings of the city with gas for two years, was renewed last May, at $1.75, as against $1.25 for the two previous years. Contracts for lighting the public lamps for two years were renewed last August on satisfactory terms. The total number of street lamps lighted is 5,100, or the same as a year ago. The price of coal (a most important factor in San Francisco) last year was the lowest ever known, and the Company reaped the benefit thereof. Recently a satisfactory test was yielded by a trial of South Prairie coal, and the Company, in consequence, contracted for a supply of from two to three thousands tons per month of that variety at the figure of $5 per ton; also for two thousand tons per month of Nanaimo coal, at $6 per ton. The Company has now on hand 20,000 tons of coking coal, equal to four months' supply, and a good stock of cannel is in store. Gas sales for the past year show a five per cent. increase over the figures for 1885; but the receipts on account of ammonia, coke and tar show a decrease. New meters to the number of 4,877 were placed during the year, and 3,749 were returned—a net gain of 1,128. The payments made by the city foot up at $218,157, an increase of $2,238. Salaries and wages during year absorbed $368,692, a decrease of $4,398. The Company is now in good financial condition.

Wants an Electric Light Plant.—Mr. Z. R. Brockway, General Superintendent of the State Reformatory, at Elmira, N. Y., acting on behalf of the Board of Managers of that institution, informs electric lighting plant contractors that sealed proposals will be received, until midday of March 15, at his office, for a complete electric lighting plant, the same to be erected in accordance with the specifications, to be furnished on application, and plans on file at the Reformatory. Bids must be accompanied by a certified check covering 25 per cent. of the face value of the proposition. The number of lights to be furnished is placed at 1,728 incandescent and 30 arcs.

New Gas Company.—The Castleton (S. I.) Gas Light Company has just been organized. Among those interested are Messrs. Robt. Moore, George Bechtel, E. P. Doyle, E. Wygant, Mon. Eckstein, S. F. Rawson, E. C. Blackford, Daniel Pelton, C. E. Griffith, and H. D. Leslie. A pretty solid lot. The capital stock of the Company is placed at $50,000. Castleton is on the north shore of Staten Island, and embraces the villages of Tompkinsville, New Brighton, Castleton Corners, etc. Sailors' Snug Harbor is located there.

Number of Public Lamps at Norristown, Pa.—Norristown, Pa., now maintains 126 gas and 88 oil lamps on her streets. During January 40 oil lamps were changed to the gas system.

Repairing the Breaks.—The earthquake experience of the Charleston (S. C.) Gas Light Company has so far caused to it a loss of about $25,000. The repair gangs have detected and repaired over 500 leaks, and about 100 of these were caused by actual fracture of the conduits. It is estimated that the leakage at the present time is about 20 per cent. of the make.

Deprived of their Gas.—The City Attorney of Muncie (Ind.), acting under orders from the Common Council, yesterday commenced proceedings to enjoin the Muncie Gas Company from running natural gas through its mains. The Council claims the company has no right under its franchise to furnish anything but coal gas, and that by furnishing natural gas it has forfeited its franchise.

No One Doubts it in this Establishment.—Our Western correspondent, "Retort," in his current batch of "Notes from the West," affirms that "$ gas has come to stay." To which assertion we reply, "Of course." And we will submit the further explanation that no one connected with 42 Pine street ever thought otherwise.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

"A. S." is Not Convinced.

New York, Feb. 8, 1887.

To the Editor American Gas Light Journal:

Allow me to say a few words concerning Mr. Egner's reply to my notes on naphtha gas as an enricher.

I accept Mr. E.'s explanation as to obtaining 12,163 cu. ft. of gas from 2,240 lbs. of coal and 4.8 galls. of oil, instead of from 2,211.2 lbs. of coal and same quantity of oil, as I had understood it. I further note that his oil actually weighs 6¼ lbs. per gall. instead of 6 lbs., as I had estimated. These corrections will, however, change my figures but slightly.

Under heading "Third" Mr. E. seems to charge me with misquoting his statement on the illuminating power of gas obtained from Youghiogheny coal alone in making it 17 candles. My quotation was, however, correct, as Mr. E. says, near foot of second column, page 363, issue of December 16, 1886: "The coal was again tested by itself and shown to produce 4.89 cu. ft. of 17-candle gas per pound."

Allowing the above corrections, and assuming that every particle of the oil had been converted into a fixed gas (although this cannot be done), we have—

Gas from 2,240 lbs. of coal and $4.8 \times 6\frac{1}{4} = 30$ lbs. of oil		12,163 cu. ft.
2,240 lbs. of coal Mr. E. reports to yield..		10,953 cu. ft.
The 30 lbs. of oil, converted into gas of 0.850 density, will yield	460 "	
		11,413 "
Gas unaccounted for		750 cu. ft.

The 750 cu. ft., Mr. E. explains, consists of gas saved and of air and furnace gases drawn in by over-exhaust. That there is no gain in the long run by over-exhausting and unsealing of dip-pipes has been demonstrated time and again. In a well ordered retort house, such as Mr. E. is probably possessed of, the amount of gas lost through leaky joints, the pores of retorts, etc., should be but trifling, and by far the largest portion of the above 750 cu. ft. would, then, appear to be air pure and simple. If this was not the fact what would prevent Mr. E. from using the same gas-saving over-exhaust when making coal gas alone, if not the fear of seeing the illuminating power go out of sight altogether?

The "enriching" process as practiced at the Laclede works seems to be the adding to the coal gas of a certain quantity of oil gas and a still larger quantity of air; but even if the volume of the latter was only equal to that of the former, or 50 per cent. of the "enriching" mixture, the illuminating power of this mixture would be, according to Mr. Farmer's rule (the oil gas being 70 candles)—

$$\frac{50 \times 70 - 50 \times 50}{100} = 10 \text{ candles.}$$

The effect of enriching 17-candle coal gas with this 10-candle oil gas and air mixture must necessarily be in the retrograde direction.

Verily, if Mr. E.'s station meter is correct, then his photometer must need overhauling badly.

A. S.

The Market for Gas Securities.

Consolidated shares were strong and active at commencement of last fortnight, having sold up as high as 86⅞, but subsequent reaction caused a recession to 84¼. To-day (Feb. 14) the market opened at 85, and the tone is steady. Equitable has been listed on the Exchange, and apparent sales were made as high as 117. The stock is steady to strong. Mutual has also developed some strength, and it would appear that these shares, at ruling quotations (103 to 105) ought to be a purchase. Brooklyn securities do not show any change of moment, but that is easily accounted for on the ground of the Albany doings. As before hinted in our market report, the Legislature does not seem inclined to make a lower compulsory rate for gas in the City of Churches than $1.50 per thousand. In fact the Senate Committee that considered the Griswold bill reported back the measure with an amendment fixing the price at $1.60. Nothing of interest from out-of-town. We would ask Secretaries of Companies which appear in our list to kindly furnish us occasional reports of late actual sales, in order that the given quotations may be authentic.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

February 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	84½	85
Central	440,000	50	30	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	115	117
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	113
Mutual	3,500,000	100	103	105
" Bonds	1,500,000	1000	101	—
Municipal, Bonds	750,000		—	—
Northern	125,000	50	36	—
" Scrip	108,000			
Yonkers		50	51	55
Richmond Co., S. I.	300,000	50	50	—
" Bonds	12,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	104	—
Citizens	1,200,000	20	—	68
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	135	—
" Bonds	300,000		—	106
Peoples	1,000,000	10	54	56
" Bonds	290,000	—	100	—
" "	250,000	—	100	—
Metropolitan	1,000,000	100	78	80
Nassau	1,000,000	25	102	104
" Ctfs	700,000	1000	100	—
Williamsburgh	1,000,000	50	125	—
" Bonds	1,000,000	—	107	—
Out of Town Gas Companies.				
Boston (Mass.) Gas Co.	2,500,000	500	870	875
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	140	145
" " Bonds.	45,000	—	—	—
Chicago Gas Co., Ills	5,000,0000	25	142	145
Peoples G. L. & C. Co., Chicago, Ills	3,000,000		29	31
Cincinnati G. & C. Co.	6,000,000	100	183	185
Consolidated, Balt.	6,000,000	100	60½	—
" Bonds	3,600,000		107	107½
Chesapeake, Balt.	1,500,000	100	79	80
"	1,000,000		100	102
Consumers Toronto	1,000,000	50	194½	196½
Central, S. F., Cal.			82½	84
Capital, Sacramento, Cal.			55	58
Hartford, Conn.	750,000	25	140	142
Jersey City	750,000	20	155	—
Laclede, St. Louis, Mo.	1,600,000	100	110	112
Louisville, Ky.	1,500,000	50	113½	115

WANTED,

By the Chesapeake Gas Company, of Baltimore City,

AS GENERAL FOREMAN OF ITS GAS WORKS,

a first-class man, engineer, and mechanic; one who has had experience, and thoroughly understands steam, and who is absolutely temperate and sober. Address, with references,

A. B. PROAL, Sec. Chesapeake Gas Co., Baltimore, Md.

Superintendent's Position Desired

By a practical man of twenty-five years' experience in the manufacture and distribution of coal and water gas. Satisfactory references given. Address

646-tf "ENGINEER," care this Office.

THE GLOBE STREET LAMP.

MINER'S PATENT STREET LAMPS.

Are adapted for use of Streets, Parks, Depots, Ferries, & Private Grounds.

WITH POSTS OR BRACKETS.

Jacob G. Miner,

No. 823 Eagle Ave., New York N. Y.

FOR SALE,

Ten No. 2 Siemens Regenerative Gas Lamps,

With Factory Fixtures and Reflectors complete and in order. Only used three or four months. Will be sold cheap.

DANVILLE NAIL AND MFG. CO.,
Danville, Pa.

ENGLISH

"Journal of Gas Lighting."

Issued weekly. New volume commences Jan. 1, 1887. Price, $7 per annum. Subscriptions taken by

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COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting,

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD,
Manchester, N. H.

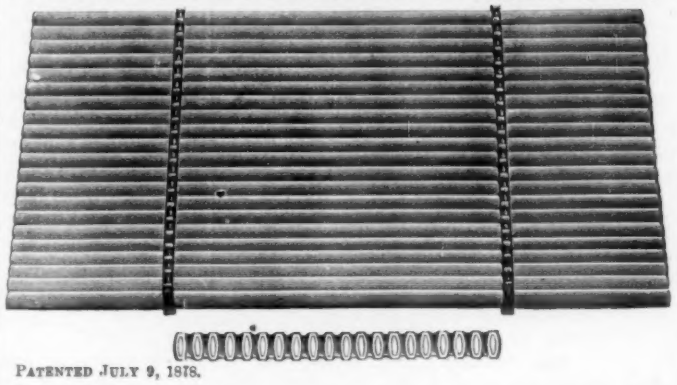
Western Agent, H. T. GEROULD, Mendota, Ill.

Ferric Oxide for Gas Purification.

Ferric Oxide, as ground, screened, and prepared by me for purifying purposes, has now been in use for several years by many of the gas works throughout the country, including Detroit, Chicago, Milwaukee, East Saginaw, Burlington (Iowa), Ann Arbor, etc. It has proved, as I believe, the **Most Effective and Economical Agent** now in use. I am prepared to furnish the Oxide by the 100 lbs. or in car load lots, and will be pleased to give price f.o.b. cars at Ann Arbor or at place of destination. Address

S. H. DOUGLAS, Prest. Ann Arbor (Mich.) Gas Light Co.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



Patented July 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

306 to 310 11th Av., N. Y.

References in all parts of the country. Send for circular and list of companies who now have the Screen in use.

Kloenne & Bredel Improved
REGENERATIVE FURNACES
Self-Sealing Mouthpieces and Bridge Pipes,
RETORT HOUSES, WASHER-SCRUBBERS,
GASHOLDERS, AND GAS WORKS COMPLETE.

Our system of heating retorts by regenerative furnaces is the simplest, most economical, most durable, and cheapest of any in use. It is the only regenerative furnace used to any extent in Great Britain, where several thousand retorts are working at the present time. In Birmingham alone 952 retorts were erected, and they are giving the best satisfaction ever obtained from any regenerative furnaces. The great advantages our benches have over all others are the following:

The generator and regenerator are independent of each other, so that any contraction or expansion of one will not interfere with the other.

The superheating surface is greater than in any other furnace yet constructed. The regenerator is absolutely self-tightening, and cannot get out of order.

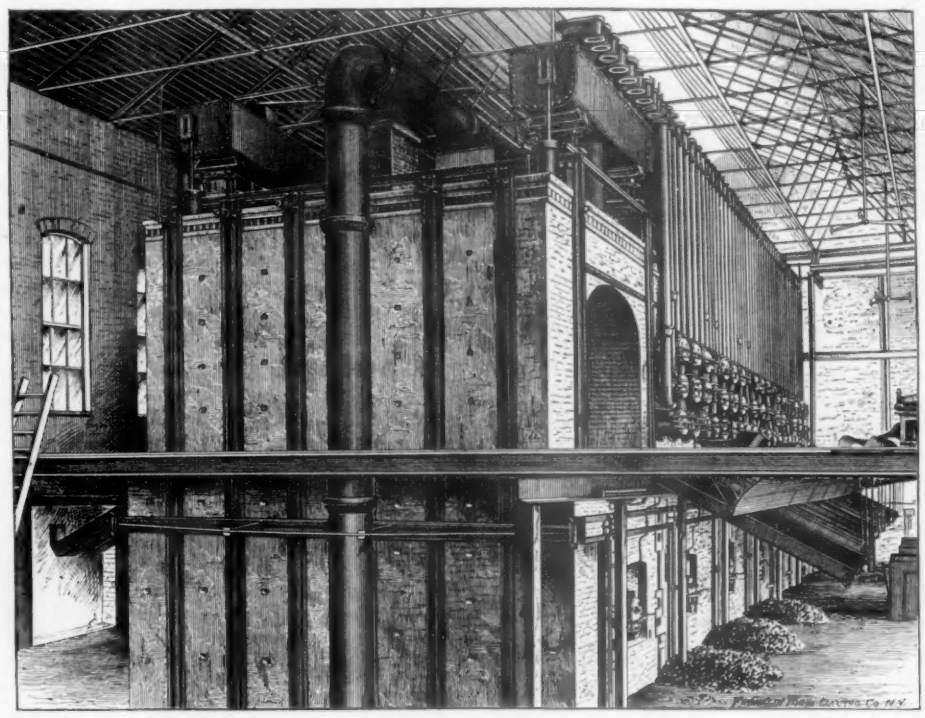
The thickness of material between the waste gases, secondary and primary air is only 1¼ inches, which increases the regenerative power from 100 to 500 per cent.

The generator is working absolutely cold, and therefore is not liable to any perceptible wear and tear.

The grate, having an enormous surface, allows the use of an inferior fuel, such as breeze, fine coke, or slack coal.

Clinkers are never formed. By an ingenious arrangement of mixing air and the steam produced by the cooling water all incombustible materials in the fuel are formed into soft ashes.

The waste gases go up through flues at 400° to 500° F. No large chimneys are required.



No cold air can enter; consequently no cracking of retorts.

The generator is inside of bench, thereby preventing any loss of heat; and stokers do not have to stand on a hot floor, as is the case where the generator projects outside of the bench.

In the past two years more than 500 retorts, with a capacity of five million cubic feet of gas per diem, have been erected in this country, and these are giving the best satisfaction, as the following testimonials will show.

We also construct h lf-regenerative benches, which will give the best results, and can be built in existing skeleton arches.

OFFICE OF THE NEWARK GAS LIGHT COMPANY, NEWARK, N. J., January 28, 1887.

MR. FREDERICK BREDEL, General Agent Kloenne Regenerative Furnace:

Dear Sir—The Kloenne Furnaces erected by you have been in continuous use for more than a year, and continue to give us satisfactory results. We are carbonizing 1,800 pounds coal per retort in 24 hours, and the average fuel consumption for this much has been 16.8 pounds by volume of the coke produced, or 100 pounds coal have been carbonized by 11.25 pounds hot coke. We have not lost a retort yet, and I think that those in use will give us six months' more service.

Very truly, [Signed] EUGENE VANDERPOOL.

ENGINEER'S OFFICE, MILWAUKEE GAS LIGHT COMPANY, MILWAUKEE, WIS., January 26, 1887.

FRED. BREDEL, C.E.: Dear Sir—Upon your request for a testimonial for publication, I am pleased to send you the following, as I consider it deserved for the way in which your contract was carried out with us. I would say to any in the profession that among all the plans of benches presented to me from which to select I chose the "Kloenne" for several reasons. I considered it perfect in principle, that at all times it would be under absolute control, and also that each block in the regeneration could be easily seen and repaired if necessary. Your work upon our benches was done as good as it possibly could have been by anyone, and such has been the opinion of the several visitors during the progress of the work and since its completion, without exception. We have been running the furnaces since Oct. 6, and as yet have observed no cracked or sagged retorts. Every part of the work appears as perfect as when set. Although the first month was used up in experimenting and learning how to run the furnaces, and since that time we have experienced very cold weather, yet we are *selling* 26 bushels of coke (40 lbs. per bushel) per net ton of coal used. The consumption of coke in the furnaces does not exceed 20 per cent. at the present season, and for the year I am sure will be materially less.

Yours truly, [Signed] E. G. COWDERY.

OFFICE OF THE CHICAGO GAS LIGHT AND COKE COMPANY, CHICAGO, ILL., January 27, 1887.

FRED. BREDEL, Esq.: Dear Sir—We have had eight benches of nines with the Kloenne furnaces running continuously for 13 months. The results have averaged 9,000 cubic feet per mouthpiece in 24 hours, with a fuel consumption of 13 pounds coke per 100 pounds coal carbonized.

Yours truly, [Signed] THEOB'D FORSTALL, *V.-P.*

For further information apply to

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332 East 17th Street, N. Y. City.

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PORTLAND CEMENT

Is guaranteed to be the finest English brand, and unsurpassed by any grade imported for making concrete and setting masonry.

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MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocks, warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

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IMPORTER of

"BRIDGEND" "DINAS"

Silica FIRE Bricks

FOR COKE OVENS AND GAS WORKS.

PORTLAND AND ROMAN CEMENTS.

Correspondence Invited. Lowest Prices.

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STANDARD GAS LAMP CO.,

Office, 411 Cherry St. Factory, 1101, 1103 & 1105 Frankford Av.

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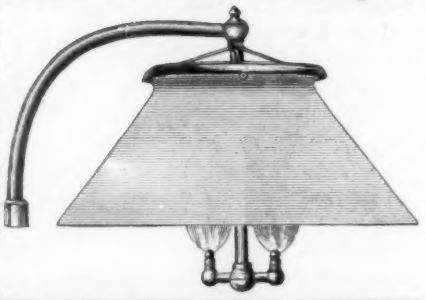
It is to the interest of Gas Companies and Cities to use Dyott's Patent Champion Lamps, which give double the light with the same consumption of gas, and will save 50 per cent. over others in cost of keeping in repair. Gas Companies and others intending to erect Lamps of any description will do well to communicate with us. Special Drawings furnished and Estimates given on application upon Architects', Engineers' or our Draughtsmen's Plans.

Our Patent System of Instantaneously Lighting Gas (without electricity) for R. R. Depots is unequaled. Our High Candle Power Burner is superior to the Electric Light or any other High Candle Burner. We manufacture every description of Ornamental Lamps.

Gregory's Retort Incandescent Gas Lamps.

Manufactured under Patents granted and applied for. **Over 20,000 sold in New York and Brooklyn. Over 100,000 sold in the U. S. in one year.** It is the only lamp that can compete with Incandescent Electric Light. Gas Companies should see that it is on sale in their city or town. They can be attached to any bracket or fixture. **A Complete Revolution in Gas Lighting.** The invention of GEO. H. GREGORY, Gas Expert. A pure white light obtained from Gas, which is **Superior to Electric Light.** All lamps are finished in nickel plate. The construction of all lamps allows the gas to be superheated before passing through the tip, rendering the illuminating properties of the gas incandescent, which causes the **Brightest Light ever obtained from Gas.** Lamps made in all sizes. Gas Companies should assist in introducing this new lamp, which exceeds all other devices for gas lighting. This Cut represents Office and Bracket Lamp. Price, **$18 per dozen**; discount 50 per cent. in half dozen lots or more. Send for Catalogue. Address



GEO. H. GREGORY, Mnfr., 337 Broadway, N. Y.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. WHYTE, who for over thirty years has made a specialty of

Holder Tank Excavation and Mason Work.

Fifty tanks now in operation show the sort of work done. Address

W. C. WHYTE, No. 15 Cortlandt St., N. Y. Citv.

DURING THE PAST YEAR, THE

NATIONAL GAS LIGHT AND FUEL CO.

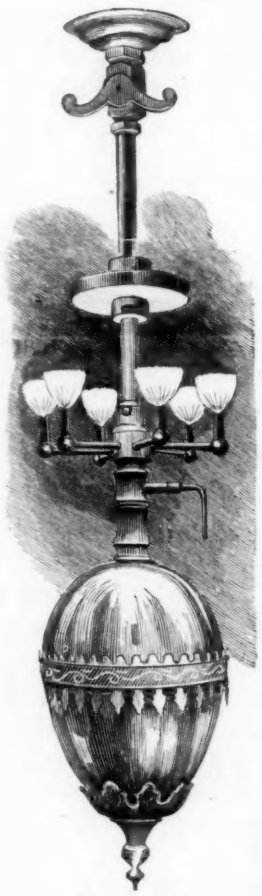
218 LA SALLE ST., CHICAGO,

Have Erected Twelve Sets of Water Gas Generating Apparatus under the *Springer Cupola* System. They are as follows:

1886

Newton Illuminating Company, Newton, Kansas.— Daily capacity, 120,000 cu. ft.
Wellington Light & Heat Co., Wellington, Kansas.— Daily capacity, 120,000 cu. ft.
Chippewa Falls, Gas Light Co., Chippewa Falls, Wis.— Daily capacity, 120,000 cu. ft.
Elkhart Gas Light & Coke Co., Elkhart, Indiana.— Daily capacity, 120,000 cu. ft.
Madison City Gas Light Company, Madison, Wis.— Daily capacity, 120,000 cu. ft.
South Bend Gas Light Co., South Bend, Indiana.— Daily capacity, 250,000 cu. ft.
Sheboygan National Gas Comp'y, Sheboygan, Wis.— Daily capacity, 120,000 cu. ft.
Salina Gas Light Company, Salina, Kansas.— Daily capacity, 120,000 cu. ft.
Rathbun Company, Deseronto, Province Ontario.— Daily capacity, 80,000 cu. ft.
Jefferson City Gas Light Co., Jefferson City, Mo.— Daily capacity, 120,000 cu. ft.
Mankato Gas Light Company, Mankato, Minnesota.— Daily capacity, 80,000 cu. ft.
Minneapolis Gas Lt. & Coke Co., Minneapolis, Minn.— Daily capacity, 1,000,000 cu. ft.

1886



THE ALBO-CARBON LIGHT.

This most successful of all methods of enriching gas is based on the use of heated gas to vaporize a solid hydrocarbon, thus

COMBINING THE ADVANTAGES OF PREHEATING AND CARBURETTING.

The incoming gas passes over an extended heating surface (heated by means of the illuminating flames), and is raised to the temperature necessary to vaporize the carburetting material, which is a white, crystalline solid prepared from coal tar.

INJUNCTION GRANTED!

In the suit between this Company as complainant and Newman A. Ransom and the Chicago Gas Apparatus Manufacturing Company as defendants, pending in the Circuit Court of the United States for the Northern District of Illinois, on a late hearing of said cause before his Honor, Judge Gresham, Judge of said Court, an order was made and entered therein, a copy of which is hereto annexed, supporting our charge of infringement of our Letters Patent No. 247,925, dated Oct. 4, 1881, and of our Letters Patent No. 333,862, dated Jan. 5, 1886, and sustaining our rights under said several Letters Patent, to which especial attention is hereby directed, viz.:

UNITED STATES CIRCUIT COURT,
Northern District of Illinois.

WALTER J. KIDD
vs.
CHICAGO GAS APPARATUS MANUFACTURING COMPANY AND NEWMAN A. RANSOM.
In Equity.

The Bill of Complaint and the affidavits filed by the respective parties having been read and the arguments of the counsel for the respective parties having been heard and duly considered by the Court—C. K. Offield, Esq., of Offield, Towle & Phelps, for the Complainant, and John H. Whipple, Esq., of Merriam & Whipple, for the defendants—and it appearing that Letters Patent of the United States were issued in due form of law to Joshua Kidd, No. 247,925, dated October 4, 1881, for an Improvement in Apparatus for Enriching Gas, also Letters Patent of the United States to said Joshua Kidd No. 333,862, dated January 5, 1886, for an Improvement in Carburetting Attachments for Gas Fixtures, and that the title to said Letters Patent vests by mesne assignments in the complainant herein; and it appearing by the answer of the defendant corporation, the Chicago Gas Apparatus Manufacturing Company, that they have never manufactured, used, or sold, or had anything whatever to do with any so-called apparatus for enriching gas of any kind or description whatever, or any carburetting attachment for gas fixtures of any kind or description whatsoever; and it appearing that said defendant, Newman A. Ransom, has infringed the second claim of said Letters Patent No. 247,925, dated October 4, 1881, and the first and second claims of said Letters Patent No. 333,862, dated January 5, 1886, by manufacturing and selling carburetting attachments for gas fixtures manufactured according to said Letters Patent contrary to the form of the statute in such case made and provided;

Now, therefore, it is hereby ordered, adjudged, and decreed, this 30th day of December, A. D. 1886, that an injunction be issued pursuant to the prayer of the Bill herein, strictly commanding and enjoining the said defendant, Newman A. Ransom, his clerks, attorneys, agents, servants, and workmen that they forthwith, and until the further order, judgment, and decree of this Court, desist from the making, using, or selling of any carburetting attachments for gas fixtures substantially as described and claimed in said Letters Patent in said above identified claims thereof; and that the complainant enter into Bond to be approved by the Clerk of said Court in the penal sum of two thousand dollars ($2,000), to said defendant, Newman A. Ransom, conditioned to pay the defendant or his legal representative all such costs and damages as shall be awarded against the complainant in case the said injunction shall be dissolved, said Bond to be filed on or before the 22d day of January, 1887.

and our suit against W. S. Horry (trading as the Crystal Carbon Light Co.), Arthur Kitson (trading as Kitson & Co.), and others, defendants, for infringement of our Letters Patent above mentioned and referred to, pending in the Circuit Court of the United States for the Eastern District of Pennsylvania, has not yet been reached for hearing.

THE ALBO-CARBON LIGHT COMPANY, - - - NEWARK, N. J.,

Sole Manufacturers for the United States.

GAS ENGINES. GAS LAMPS. BOOKS.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

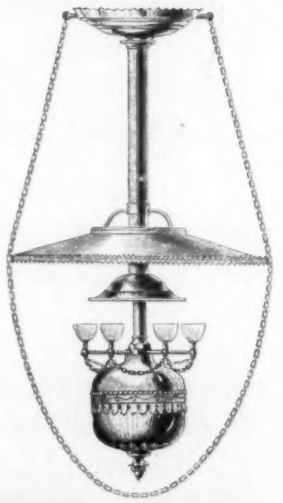
Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

TRADE MARK.

THE CRYSTAL CARBON LIGHT!

The Latest and Most Improved Gas Light!

ADAPTED FOR PRIVATE RESIDENCES, CHURCHES, THEATERS, STORES, ETC.



These Burners are manufactured on the principle of enriching gas by means of Naphthaline (so-called Crystal Carbon or Albo-Carbon), the invention of the Rev. W. R. Bowditch, F.R.S., of Wakefield, England, who was the original inventor and patentee of this system of gas lighting.

SPECIAL NOTICE.

Many Gas Companies find the Crystal Carbon Light a valuable competitor against the Electric Light. It is ornamental, free from the defects common to all other enriching gas burners, and is as cheap as ordinary gas chandeliers. We sell direct to gas companies, giving them the benefit of agents' discounts.

CARBONCRYSTAL.

(Trade Mark.)

A new and superior preparation for enriching gas used in conjunction with Crystal Carbon or Albo-Carbon gas lights. The preparation is cleaner and better adapted for filling burner vessels than any hitherto produced. Guaranteed to be chemically pure. Supplied in cans from 10 pounds up.

THIS IS THE CHEAPEST AND PUREST FORM OF ENRICHING MATERIAL.

CRYSTAL CARBON LIGHT CO.,

Main Office, No. 1018 Chestnut Street, Philadelphia, Pa.

GAS

AS A SOURCE OF

LIGHT, HEAT, AND POWER.

By C. J. R. HUMPHREYS.

A Pamphlet of twenty-nine pages, treating of the use of Gas as a source of Light, Heat, and Power.

DESIGNED FOR DISTRIBUTION BY GAS COMPANIES AMONG THEIR CUSTOMERS AND OTHERS.

Price, 10 cents each, $5 per 100, $50 per 1,000.

Gas Companies can have their own imprint placed on cover without extra charge. All orders to be sent to

A. M. CALLENDER & CO.,

No. 42 Pine Street, N. Y. City.

CONNELLY'S

AUTOMATIC GOVERNOR FOR STREET MAINS.

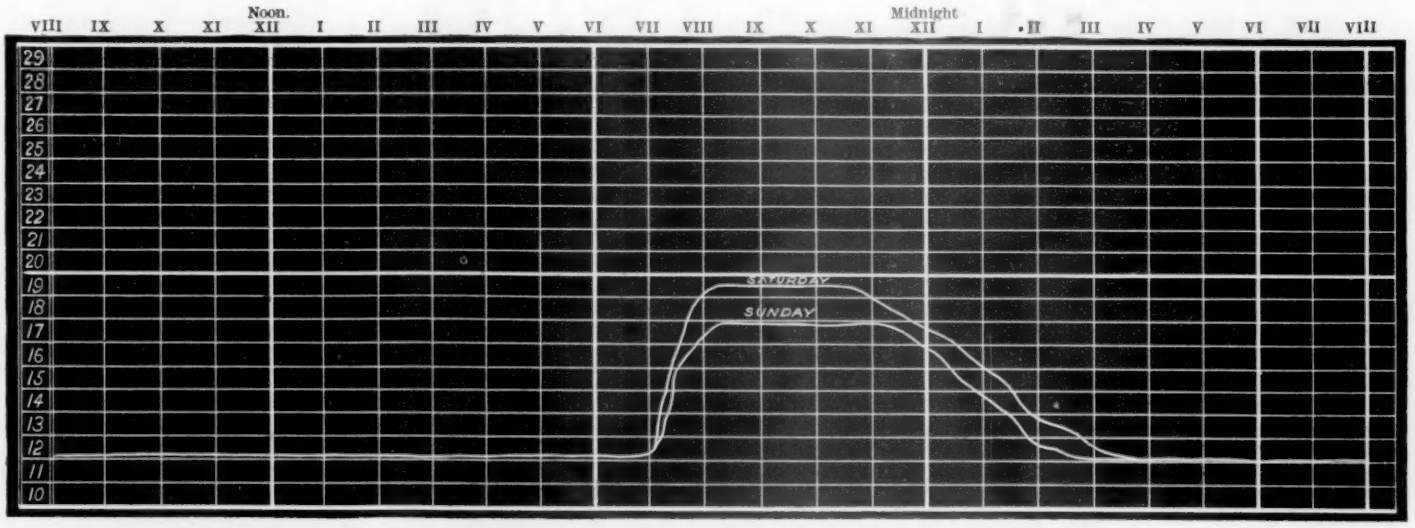
We invite the attention of all practical Gas Managers to the following letter and accompanying cut. The two lines show the pressure held by the Governor on Saturday and Sunday, and clearly illustrates the accuracy of the Governor in *increasing* and *reducing* pressure *in proportion to the volume of gas consumed.*

A Governor that puts the increased pressure on at "one fell swoop" and takes it off in like manner is *not* an "Automatic" Governor; and the circulation of pressure sheets showing such action by a so-called "Automatic" Governor is a rather amusing reflection on the intelligence of Gas Managers.

Strictly speaking, a "Balanced" Governor is an "Automatic" one, as it automatically varies the volume of gas sent out to *maintain a uniform pressure* at its outlet. But, as now applied, the term "Automatic Governor" is understood to mean a Governor that will *maintain pressure between any two desired extremes, in direct proportion to the volume of gas consumed.* Therefore pressure sheets showing *instantaneous changes* from maximum to minimum and *vice versa*, circulated broadcast as the record of an "Automatic (?) Governor," reveals inexcusable ignorance of the subject, amusing to many, yet liable to mislead the inexperienced novice.

We would suggest that all Gas Companies contemplating the placing of *Automatic* Governors would consult their own interests and avoid annoying experience by adopting a Governor *that has a record.*

CONNELLY & CO., LTD., 177 Broadway, N. Y.



Card Showing Pressure at the Milwaukee Gas Works, Saturday, July 10, and Sunday, July 11 1886.

MILWAUKEE, WIS., August 3d, 1886.

MESSRS. CONNELLY & CO., LTD., 177 Broadway, New York:

Gentlemen—Replying to yours of 29th, I send you a little package of register sheets. When your Governor (20-inch) was set I adjusted it to give 13-tenths day pressure and 22-tenths night pressure. Saturday nights it would run up to 25-tenths. Whenever it would cloud up in the daytime it would go up at first indication of darkness to about 15-tenths. I hunted back in the sheets to find one when pressure was increased in the daytime, but it is so long since we have had a stormy day I could not find one. You can, however, see a *slight change* on sheets for June 1 and June 25. You will see, too, that lately the Governor only puts on *about* 20-*tenths maximum pressure.* This is because *less gas is burned than when it was adjusted.* We have no complaints of pressure, and everyone appears satisfied. In conclusion, can say the Governor has *never been touched* since it was first adjusted, and has at all times *done just the work we wished it to do.* Very truly yours, E. G COWDERY, Engr. & Supt.

T. C. HOPPER'S

AUTOMATIC DIFFERENTIAL GAS GOVERNOR

Is now in Practical Operation, doing Perfect Automatic Service with Great Precision.

This Governor will do all and more than any other Governor on the Market.

BE SURE TO THOROUGHLY INVESTIGATE THE SUPERIOR MERITS OF THIS GOVERNOR BEFORE PURCHASING.

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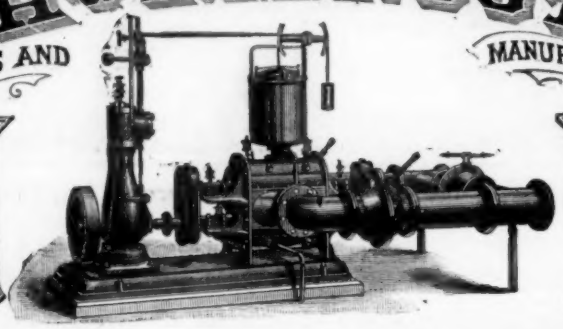

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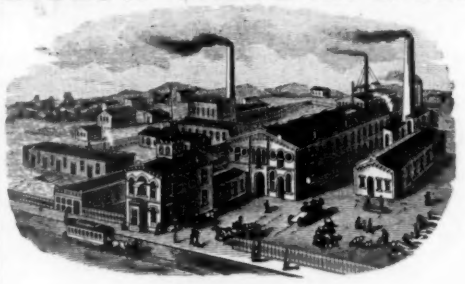

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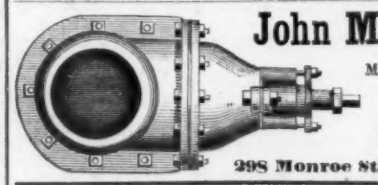

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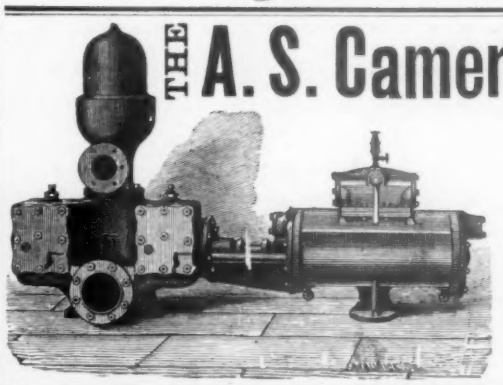

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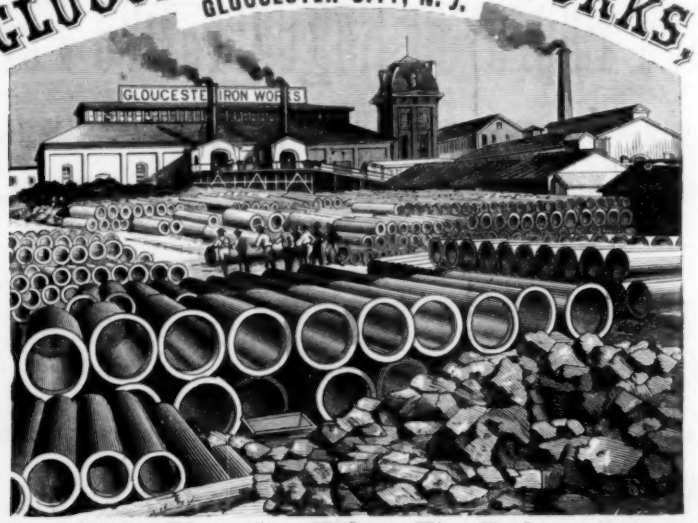

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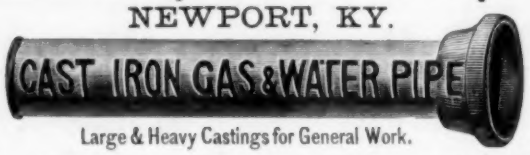

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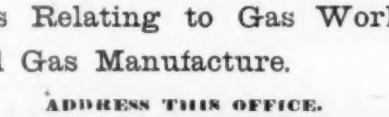

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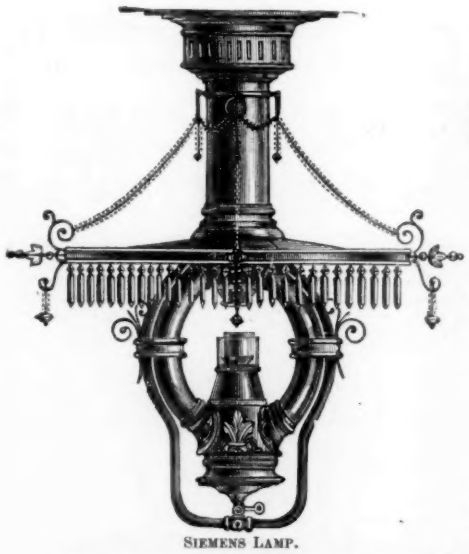

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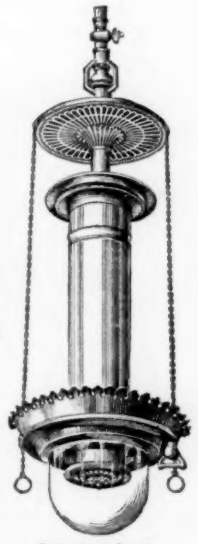

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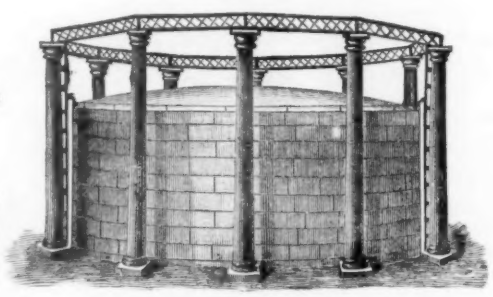

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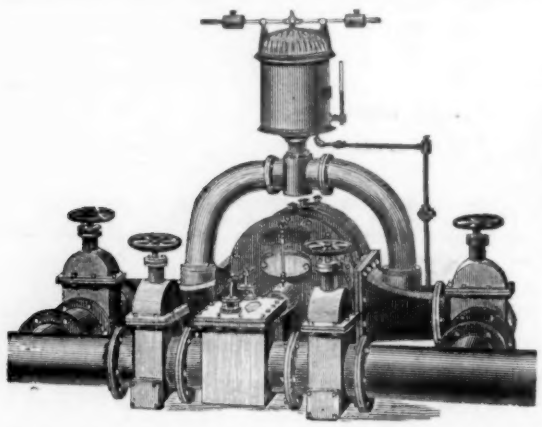

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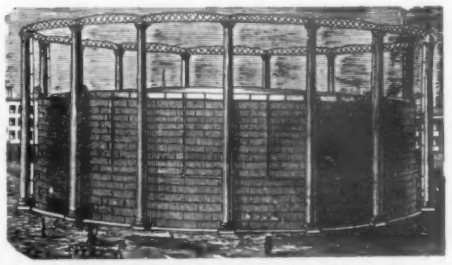

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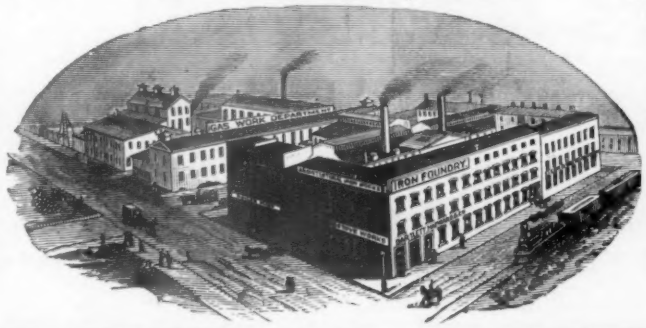

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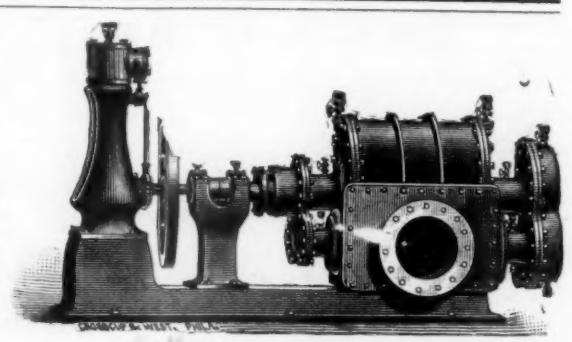

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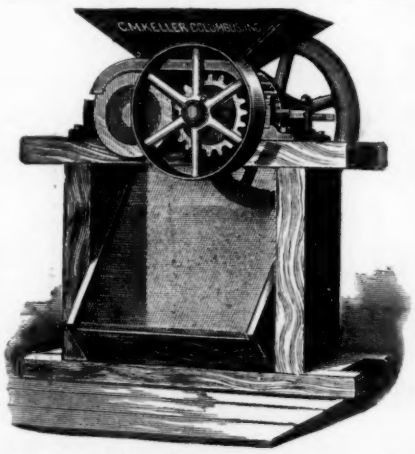

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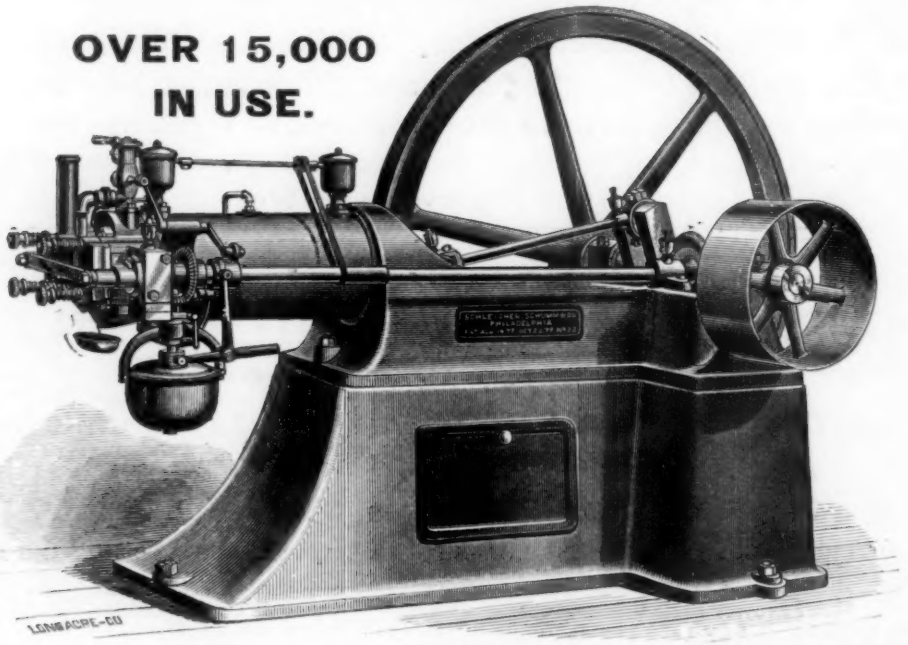

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